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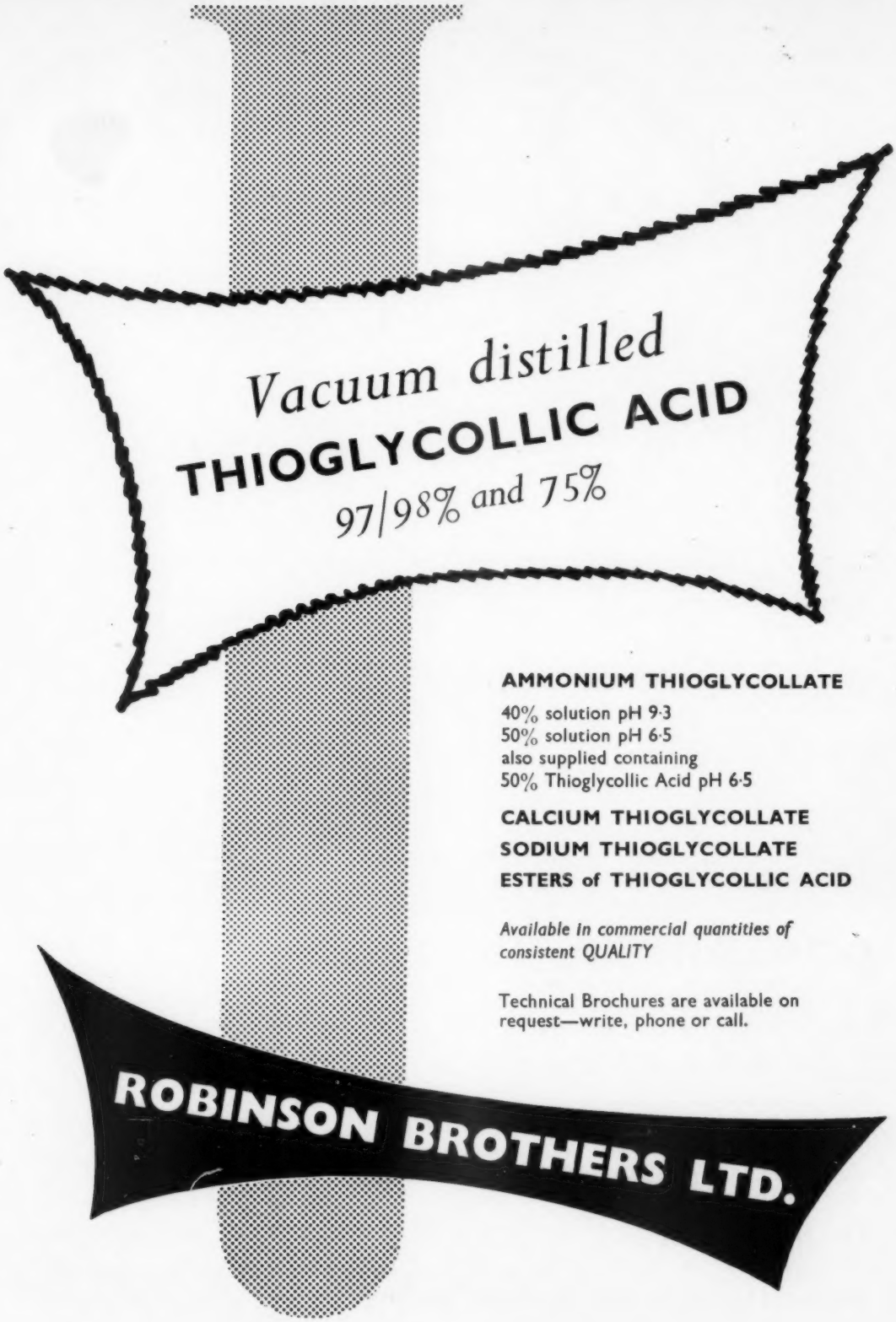

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M-W. 59

INDEX TO ADVERTISERS

	Page
A.P.V. Co. Ltd., The	Oct.
Acme Showcard & Sign Co. Ltd.	Nov
Albro Fillers & Engg. Co. Ltd.	A80
Alfermann, Friedrich-Karl	A98
Alginate Industries Ltd.	Dec.
Alice Machines Ltd.	A90
Allen, Stafford, & Sons Ltd.	A37
Allied International Co. Ltd.	Mar.
Amplex Appliances (Kent) Ltd.	A96
Anderson, C. F., & Son Ltd.	Dec.
Arden, H. B., & Co. Ltd.	Dec.
Armstrong Cork Co. Ltd.	A19
Arno Amarell	May
Arthol Ltd.	A24
Ashby, Morris, Ltd.	Dec.
Associated Metal Works Ltd.	April
Astra Chemicals Ltd.	Dec.
Autopack Ltd.	July
Auto Wrappers (Norwich) Ltd.	April
Avery, W. & T., Ltd.	Oct.
Baker Platinum Ltd.	A60
Bannister Street Works Ltd.	Nov.
Barter Trading Corporation	A36
Beatson, Clark & Co. Ltd.	A75
Beckman Instruments Ltd.	A10
Bellingham & Stanley Ltd.	May
Benjamin Electric Ltd.	A34
Bennett Sons & Shears Ltd.	June
Berk, F. W., & Co. Ltd.	A32
Betts & Co. Ltd.	Nov.
Birlec Ltd.	A48
Blachford, H. L., Ltd.	A94
Boots Pure Drug Co.	Feb.
Boulton, W., Ltd.	July
Bowser, Monks & Whitehouse Ltd.	A84
Bramigk & Co. Ltd.	Sept.
Brand, Rudolf	May
Briggs, S., & Co. Ltd.	A95
British Ceca Co. Ltd.	A84
British Celanese Ltd.	Dec.
British Cellophane Ltd.	July
British Drug Houses Ltd., The	Dec.
British Industrial Solvents Ltd.	Dec.
British Labour Pump Co.	Sept.
British Rayophane Ltd.	Dec.
British Railways	Dec.
British Road Services Ltd.	Nov.
Broadbent, Thomas, & Sons Ltd.	Nov.
Brogli, Alfred, & Co.	Aug.
Brome & Schimmer Ltd.	A96
Bromhead & Denison Ltd.	Sept.
Burroughs Wellcome & Co. Ltd.	Dec.
Bush, Beach, & Gent Ltd.	A94
Bush, W. J., & Co. Ltd.	A11
Butterfield, W. P., Ltd.	A7
C.A.S. (Industrial Developments) Ltd.	Dec.
Calfos Ltd.	A4
Cambridge Instrument Co. Ltd.	Oct.
Cannon (C.P.) Ltd.	A77
Carless, Capel & Leonard Ltd.	A78
Carlson, John C. Ltd.	Dec.
Cassidy, Peter, Ltd.	Aug.
Chemapol	A72
Chemicals & Feeds Ltd.	A96
Christy & Norris Ltd.	June
Cinema-Television Ltd.	Dec.
Clark, T. & C., Ltd.	Dec.
Clarke-Built Ltd.	Dec.
Classified Advertisements	A99, A100
Coalite & Chemical Products Ltd.	A12
Cocker Chemical Co. Ltd.	A93
Cow. P. B., & Co. Ltd.	Nov.
Cox, Arthur H., & Co. Ltd.	Dec.
Croda Ltd.	A76
Cumming, J. W., & Son Ltd.	Dec.
Cyclo Chemicals Ltd.	June
Dalmas Ltd.	A66
Dawson Bros. Ltd.	A72
Deckelmann, Josef	A98
Dehydag	Dec.
Delf, W. M. (Liverpool) Ltd.	Dec.
Deutsche Hydrierwerke GmbH	Nov.
Dexine Rubber & Ebonite Ltd.	Sept.
Dore, John, & Co. Ltd.	A44
Dragoco	A39
Durham Raw Materials Ltd.	Dec.
Dutton & Reinisch Ltd.	A45
Electronic Instruments Ltd.	July
Enamelled Metal Products Corporation	Dec.
Engineering Dev. (England) Ltd.	A90
English Clays, Lovering Pochin & Co. Ltd.	Dec.
Evans Chemicals Ltd.	A64
Evans Medical Supplies Ltd.	Dec.
Evans, Norman, & Rais Ltd.	A74
Excorna	A96
Farrow & Jackson Ltd.	A97
Fatoils Ltd.	A98
Ferranti Ltd.	A70
Fifer, A., Ltd.	A76
Firth-Vickers Stainless Steels Ltd.	A27
Flexile Metal Co. Ltd.	A65
Fluid Equipment Co. Ltd.	Dec.
Foamite Ltd.	A84
Follsain-Wycliffe Foundries Ltd.	A92
Ford, T. B., Ltd.	Dec.
Foster, Yates & Thom Ltd.	Cover 2
Fraser & Fraser Ltd.	Aug.
Fraser, W. J., & Co. Ltd.	Dec.
Freeman, Wm., & Co. Ltd.	A46
Funditor, Ltd.	Nov.
Gale, Ronald, & Co. Ltd.	A31
Gallenkamp, A., & Co. Ltd.	Dec.
Gardner, Wm., & Sons (Gloucester) Ltd.	A67
Gibbs, Antony, & Sons Ltd.	A96
Gilbert, G. R., Ltd.	Oct.
Giusti, T., & Son Ltd.	A53
Givaudan, L., & Co. Ltd.	Dec.
Glass Containers (Medical) Ltd.	Oct.
Glastics Ltd.	A61
Glaxo Laboratories Ltd.	Dec.
Glenham Products Ltd.	May
Glovers (Chemicals) Ltd.	A8
Goetz, Hermann	May
Gosheron, John, & Co. Ltd.	Dec.
Goya Ltd.	Aug.
Graesser Salicylates Ltd.	Dec.
Graesser-Thomas, H.W., Ltd.	A86
Griffin & George Ltd.	A17, A56
Gurr, Edward, Ltd.	Dec.
Haigh, John, & Co. Ltd.	Dec.
Hall, J. Edward, Ltd.	July
Hall & Lane Ltd.	Dec.
Harrison Carter, J., Ltd.	Dec.
Harvey, G. A., & Co. (London) Ltd.	A62
Hathernware Ltd.	A49
Haworth (A.R.C.) F., Ltd.	A60
Heinz, Carl Aug.	A97
Herbst, F., & Co.	A98
Heston Equipment Co. Ltd.	A33
Hilger & Watts Ltd.	A68
Hobart Mfg. Co. Ltd.	Nov.
Hoechst Chemicals Ltd.	A68
Honeywell-Brown Ltd.	Feb.
Honeywill Atlas Ltd.	A66
Honeywill & Stein Ltd.	Dec.
Horner, L. A., & Sons Ltd.	A92
Hunting-Clan Air Transport Ltd.	Sept.
Ideal Capsules Ltd.	A58
Impact Extrusions Ltd.	Dec.
Imperial Chemical Industries Ltd.	A23, A26, A30, A55
Industrial Appliances Ltd.	May
Industrial Tapes Ltd.	Oct.
International Bottle Co. Ltd.	A16
Inverni & Della Beffa S.p.A.	May

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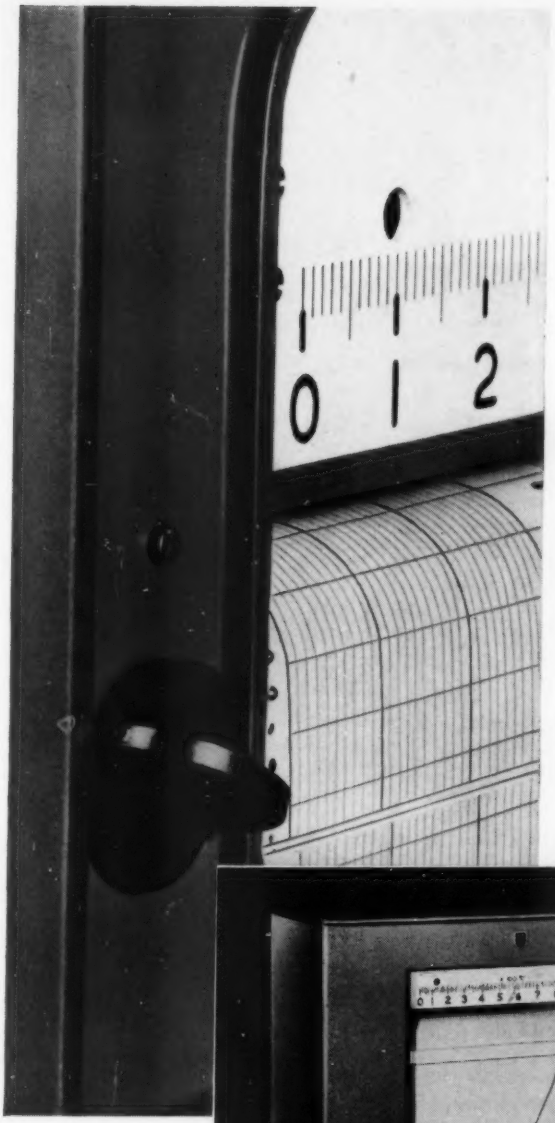
INDEX TO ADVERTISERS

	Page
Isopad Ltd.	A80
Ivers-Lee Ltd.	Dec.
Jackson. J. G., & Crockatt Ltd.	A88
Jacobson Van Den Berg & Co. (U.K.) Ltd.	A92
Johns-Manville Co. Ltd.	Sept.
Johns, Son & Watts Ltd.	Nov.
Johnsen & Jorgensen Ltd.	A38
Johnson, S. H., & Co. Ltd.	A91
Johnston "Lightning" Filler Co.	Nov.
Jones, Samuel, & Co. Ltd.	A28
Kaylene (Chemicals) Ltd.	A58
Kek Ltd.	Nov.
Kellys, John (London) Ltd.	Dec.
Kemball, Bishop & Co. Ltd.	Dec.
Kemwall Engineering Co.	A88
Kendall, F., & Son Ltd.	A98
Kestner Evaporator & Engg. Co. Ltd.	A78, A91
Kiessling, Quarzschmelze Erich	A98
Kimpton Bros. Ltd.	Nov.
Kolmar Cosmetics (England) Ltd.	A21
Kork-N-Seal Ltd.	Dec.
K. W. Chemicals Ltd.	A97
Lacrinoid Products Ltd.	Sept.
Lankro Chemicals Ltd.	A81
Laporte Chemicals Ltd.	Dec.
Lattimer, H.	A98
Lautier Fils	A42
Lavino (London) Ltd.	A18
Lax & Shaw Ltd.	A70
Lennox Foundry Co. Ltd.	A93
Lep Transport Ltd.	Dec.
Leybold Vacuum Sales Ltd.	Nov.
Link, Alfred	A98
Manesty Machines Ltd.	Dec.
Manlove, Alliott & Co. Ltd.	A41
Manning, A. J. Ltd.	A92
Marchon Products Ltd.	A43
Mark-O-Print Ltd.	Dec.
Marston Excelsior Ltd.	A55
May & Baker Ltd.	A47
M.C.P. Pure Drugs Ltd.	A86
Metafiltration Co. Ltd., The	Dec.
Metal Box Co. Ltd., The	Cover 3
Metal Hydrides Inc.	A56
Midland Employers' Mutual Assurance Ltd.	Oct.
Midland Tar Distillers Ltd., The	Oct.
Miller, P. & L., Ltd.	Dec.
Minnesota Mining & Mfg. Co. Ltd.	Sept.
Mitchell, L. A., Ltd.	A89
Mono Pumps Ltd.	Dec.
Monsanto Chemicals Ltd.	Sept.
Moritz Chemical Engg. Ltd.	A86
Morson, Thomas, & Son Ltd.	Dec.
Mulberry Co., The	Dec.
National Glass Works (Yorks) Ltd.	A29
National Industrial Fuel Efficiency Service	Mar.
Nu-Swift Ltd.	June
N. V. Sluy Boechout	A87
Olley, C., & Sons Ltd.	Dec.
Ormerod Engineers Ltd.	April
Page, Chas., & Co. Ltd.	Dec.
Palfrey, Wm. Ltd.	A5
Pan-African Advtg. Co. (Pty.) Ltd.	Sept.
Pascall Engineering Co. Ltd.	Dec.
Paterson Engineering Co. Ltd.	Dec.
Pearce, L. R. B., Ltd.	A97
Pearlite Box Co. Ltd.	Dec.
Peerless & Ericsson	A62
Petrochemicals Ltd.	A71
Pharmaceutical Press, The	Dec.
Philips Electrical Ltd.	A9
Philips Telescopic Taps Ltd.	May
Plastic Closures Ltd.	Nov.
Plenty & Son Ltd.	A64
Polak & Schwarz	Dec.
Poth, Hille & Co. Ltd.	A54
Potter & Clarke Ltd.	Dec.
Precast Utilities (London) Ltd.	Nov.
Premier Colloid Mills Ltd.	A83
Prudential Ass. Co. Ltd., The	May
Pulverizing Machinery Ltd.	A13
Purdy Machinery Co. Ltd.	Dec.
Pyrene Co. Ltd.	Oct.
Pyrethrum Board of Kenya	Cover 4
Ransomes, Sims & Jefferies Ltd.	Oct.
Reed, R. P., Ltd.	A82
Reed Corrugated Cases Ltd.	Dec.
Rejafix Ltd.	Oct.
Remploy Ltd.	Sept.
Renham & Romley Ltd.	A96
Rexolin Chemicals	Dec.
Rhone-Poulenc, Soc. des Usines Chimiques	A15
Richford, E. M., Ltd.	A86
Roberts Patent Filling Machine Co. Ltd.	Dec.
Robinson Brothers Ltd.	A3
Robinson & Sons Ltd.	A69
Roche Products Ltd.	Dec.
Ronsheim & Moore Ltd.	A14
Roussel Laboratories Ltd.	A51
Rubeck, H., Ltd.	Dec.
Sanders, H. G., Sons Ltd.	Nov.
Saniguard Appliances Ltd.	A82
Scan	A59
Scherer, R. P., Ltd.	Cover 1
Schimmel Boehm Ltd.	June
Sellotape Industrial	Sept.
Service Electric Co. Ltd.	Dec.
Shell Chemical Co. Ltd.	Nov.
Siemsgluss, Frido	A63
Silverson Machines (Sales) Ltd.	Dec.
Simpson, W. S., & Co. Ltd.	A98
Sipon Products Ltd.	Oct.
Smith, T. & H., Ltd.	A40
Smith & McLaurin Ltd.	A35
Stainless Steel Vessels (London) Ltd.	Dec.
Standard Synthetics Ltd.	A79
Star Machinery Pty. Ltd.	Dec.
Steel, J. M., & Co. Ltd.	A73
Stephens Bros. & Banner Ltd.	A54
Sturge, J. & E., Ltd.	Dec.
Sturtevant Engineering Co. Ltd.	Dec.
Sutalite Ltd.	Nov.
Sutcliffe Speakman, & Co. Ltd.	Dec.
Taylor Rustless Fittings Co. Ltd.	Dec.
Tennants (Lancashire) Ltd.	A90
Thames Board Mills Ltd.	A50
Thompson & Capper Ltd.	Dec.
Tickopres Div., Dapag (1943) Ltd.	Dec.
Tillotson & Sons Ltd.	A25
Todd Bros. (St. Helens & Widnes) Ltd.	Nov.
Townson & Mercer Ltd.	June
Trade Agent for Mysore	A88
Trade Commissioner for the British West Indies, British Guiana and British Honduras	Dec.
Transparent Paper Ltd.	June
Trapow, D., & Co. Ltd.	A95
Tungstone Products Ltd.	Dec.
Ultrasonics Ltd.	A6
Union Carbide Ltd.	A85
United Glass Bottle Mnfrs. Ltd.	A22
United Indigo & Chemical Co. Ltd.	Dec.
Universal Metal Products Ltd.	Sept.
Universal Oil Co. Ltd.	A57
Universal Postal Frankers Ltd.	Nov.
Venesta Ltd.	A89
Vickerys Ltd.	Dec.
Viscose Development Co. Ltd.	Nov.
Wasserman, G. A.	Sept.
Webb, Wm., Ltd.	May
Weddel Pharmaceuticals	Dec.
Welch, J. A. (Plant & Vessel) Ltd.	A88
Westbrook Lanolin Co.	Dec.
White Sea & Baltic Co.	A90
Willcox, W. H., Co. Ltd.	A20
Woodhams, Dade & Co.	A96
Wood-Wool & Fibre Co. Ltd.	A94



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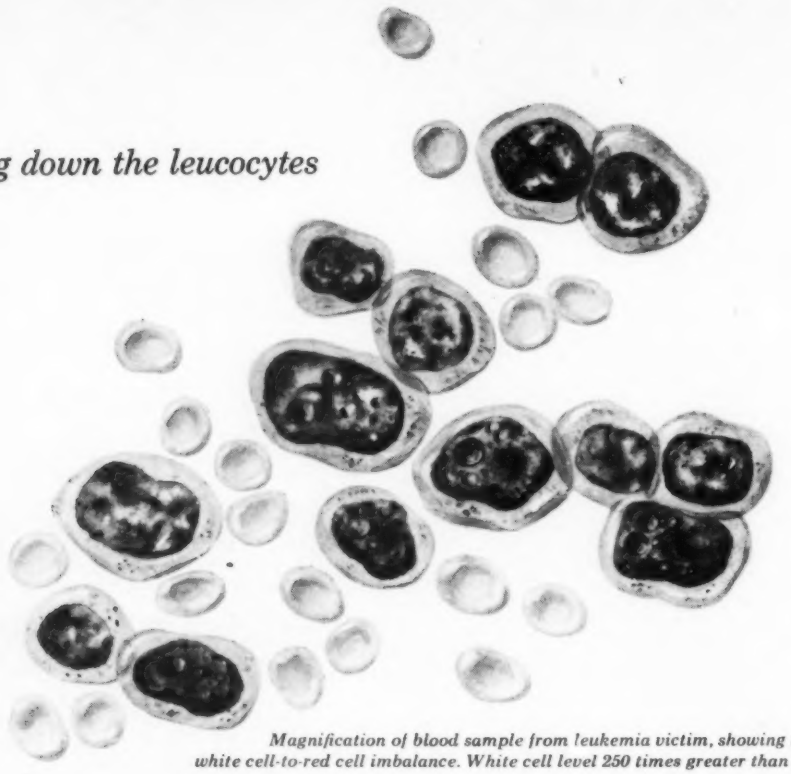

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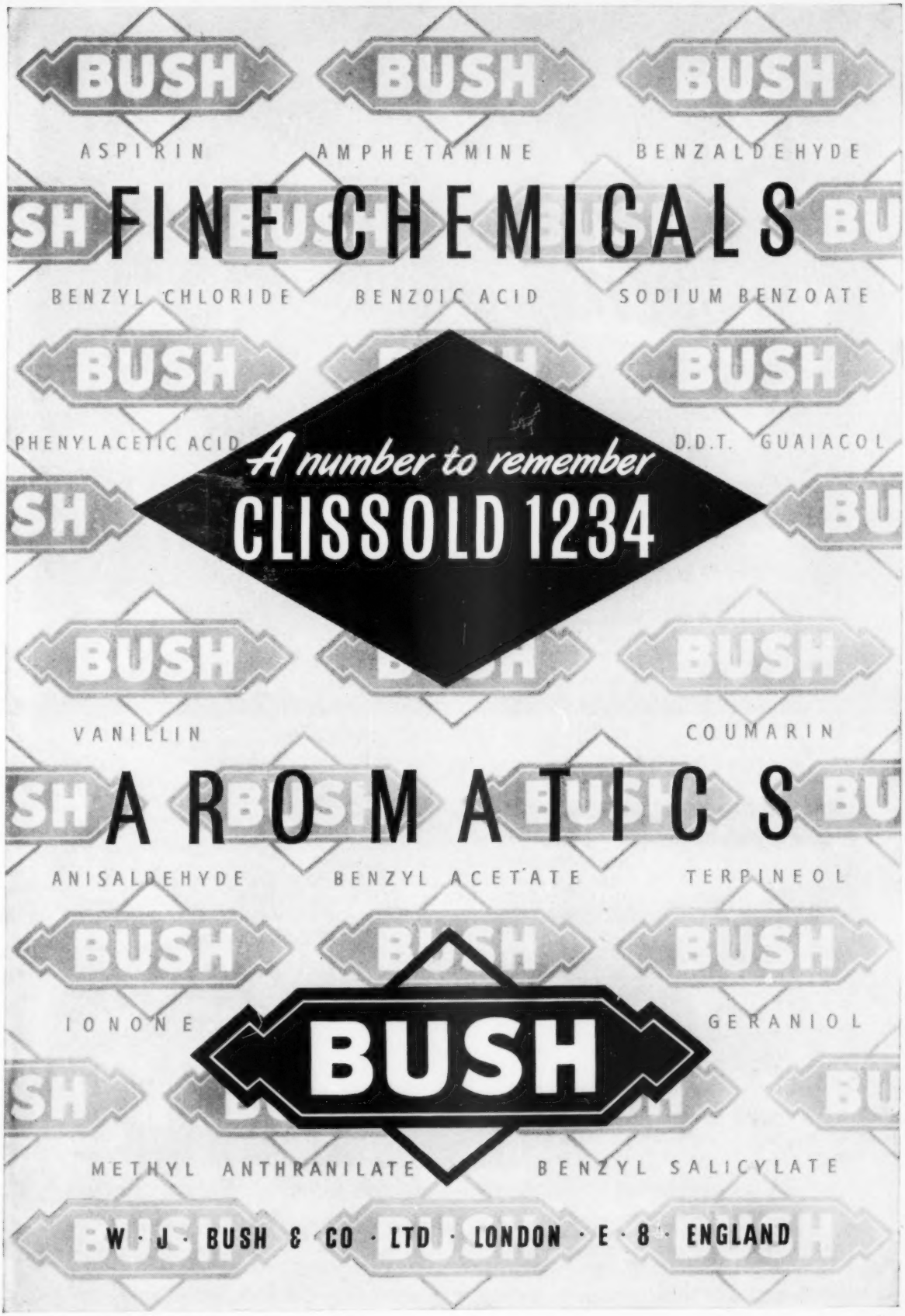
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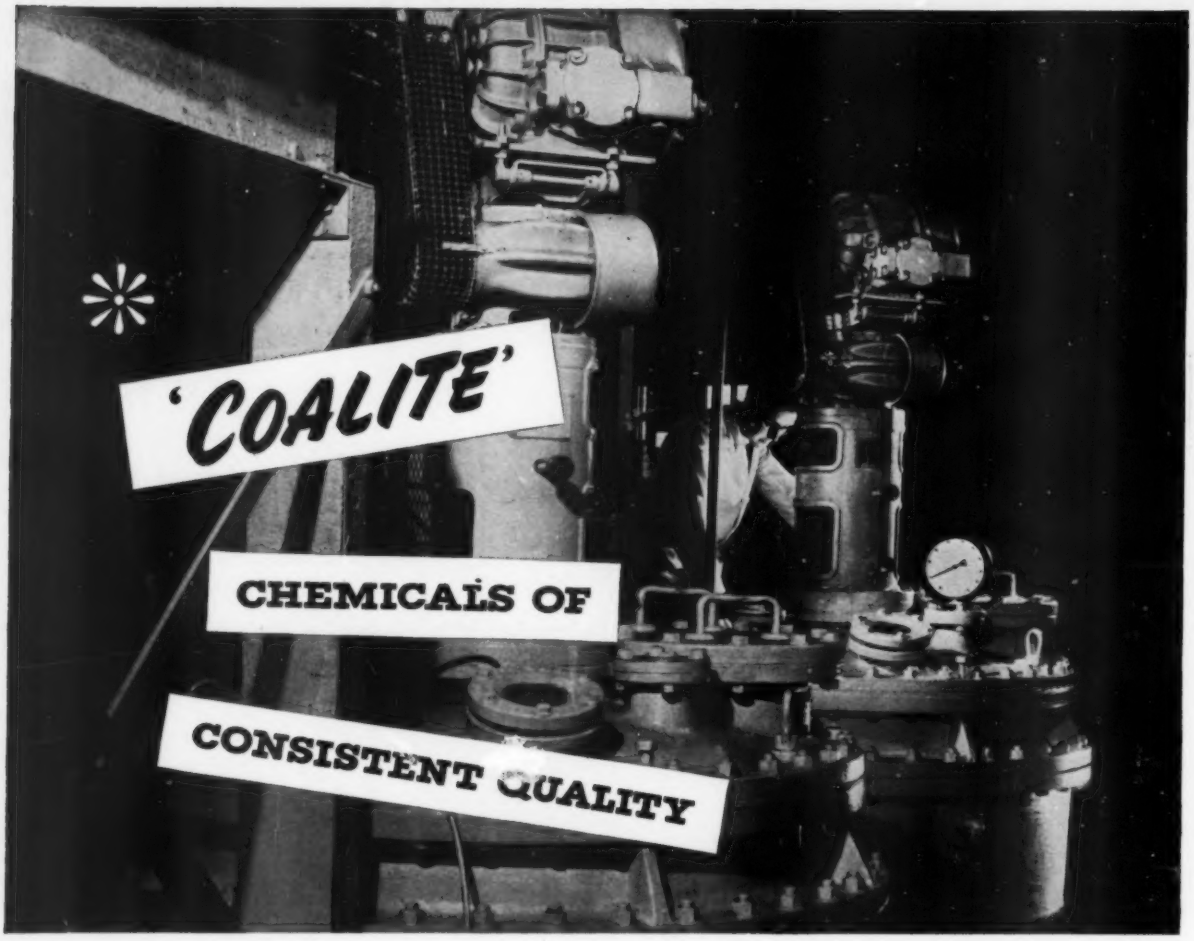

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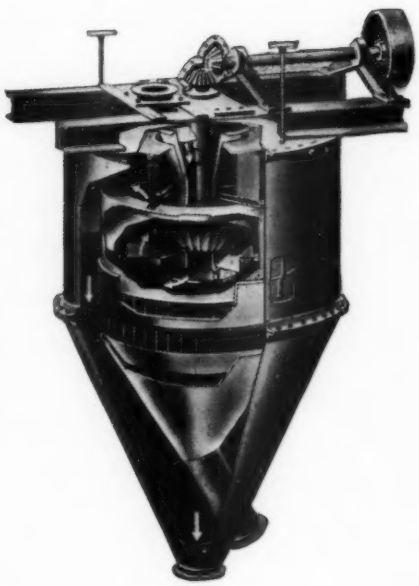

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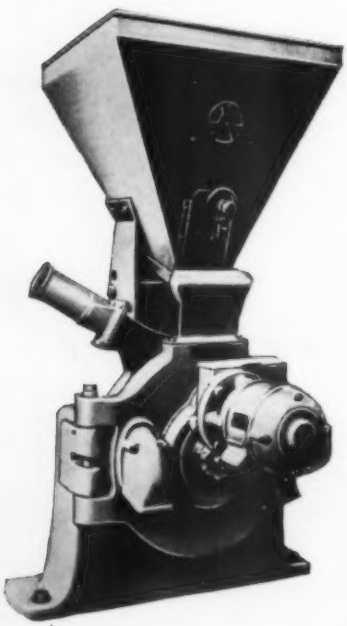

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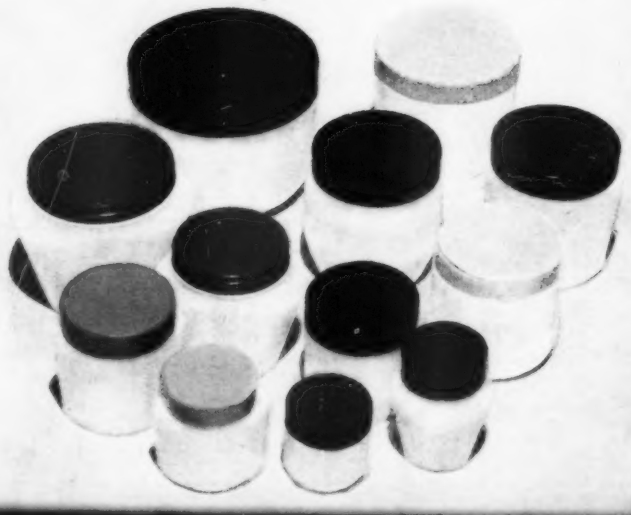

January Guide to Buyers

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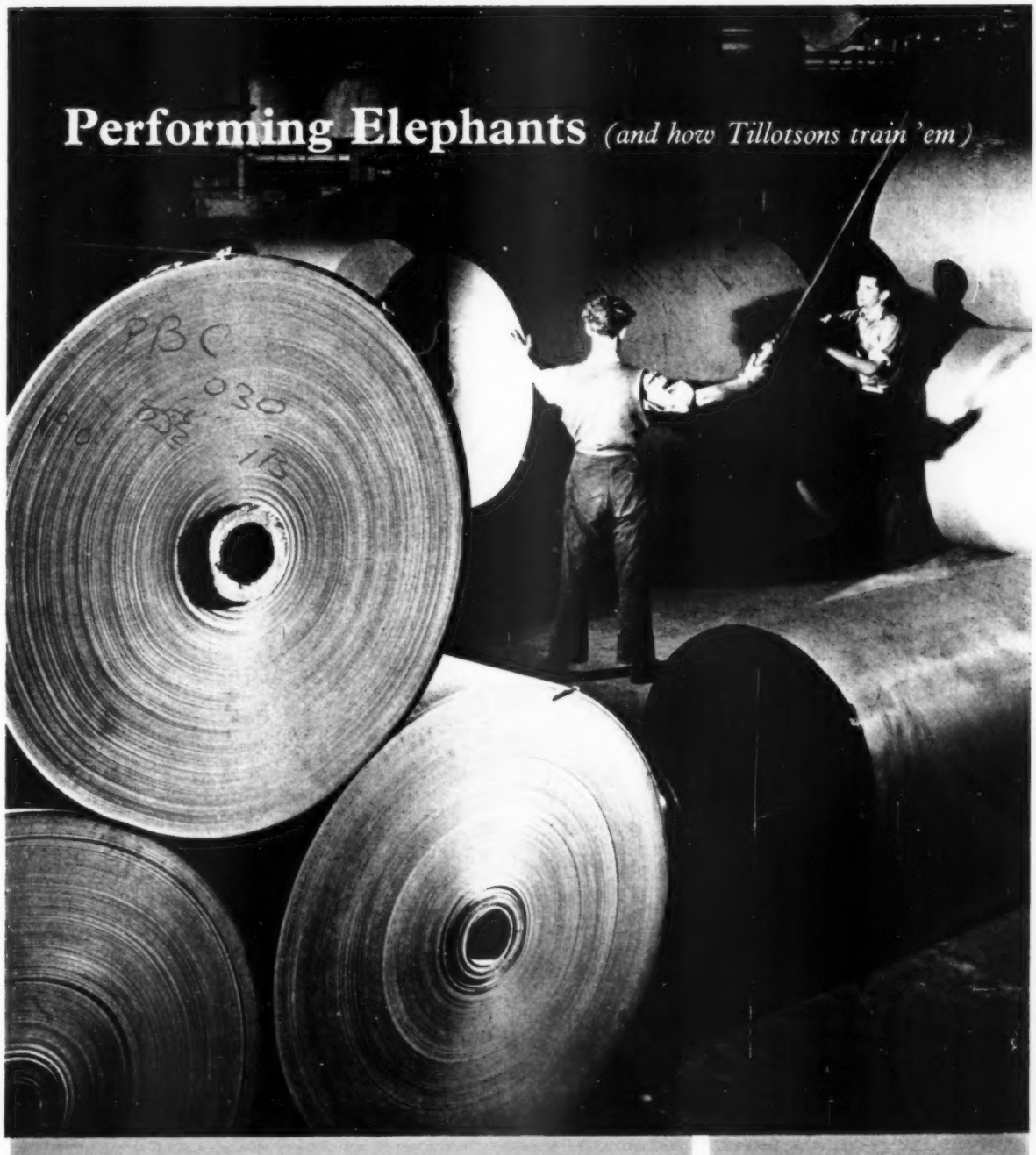

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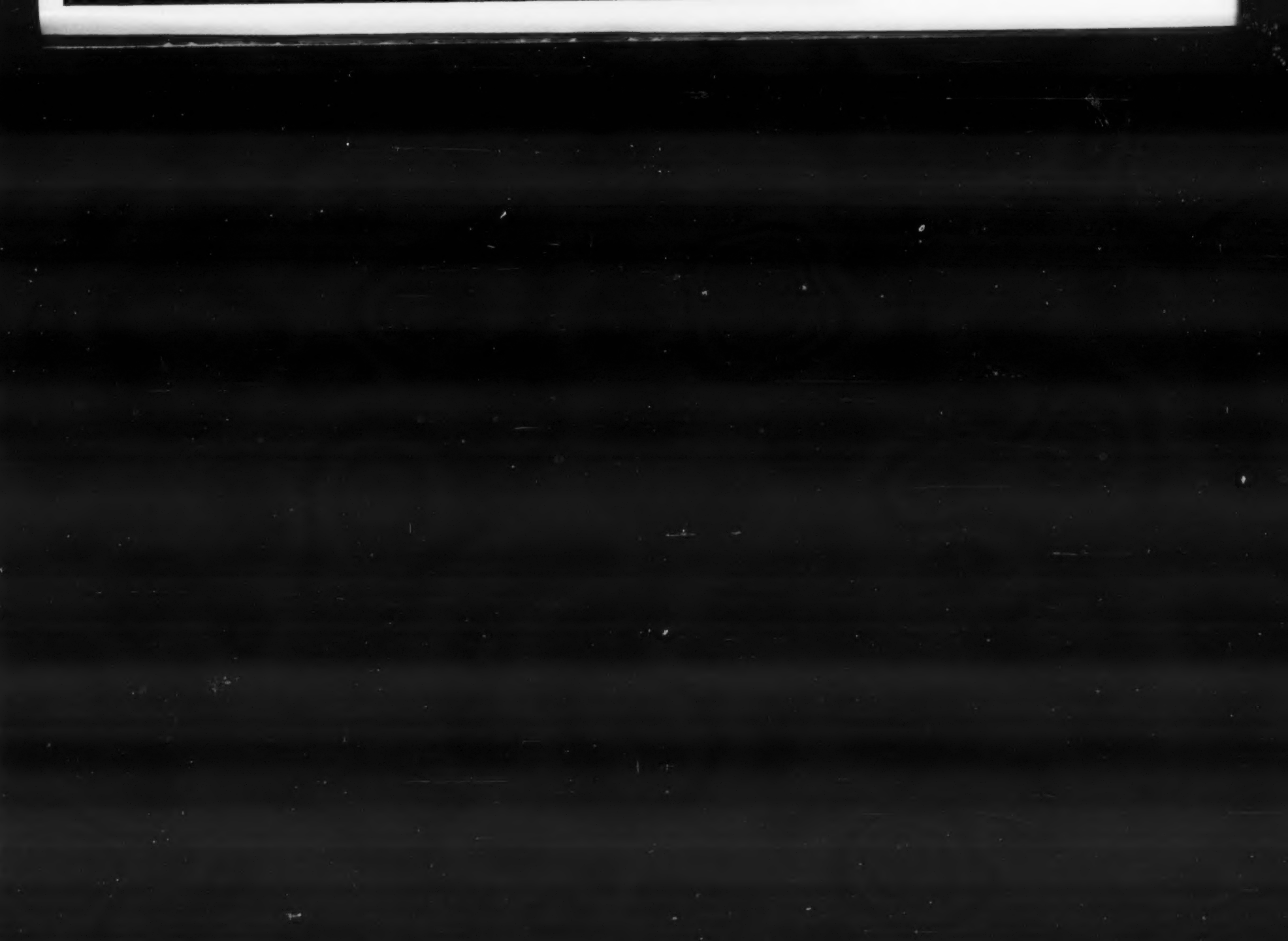
Both flexible and rigid foams provide excellent insulation against mechanical and thermal shock.

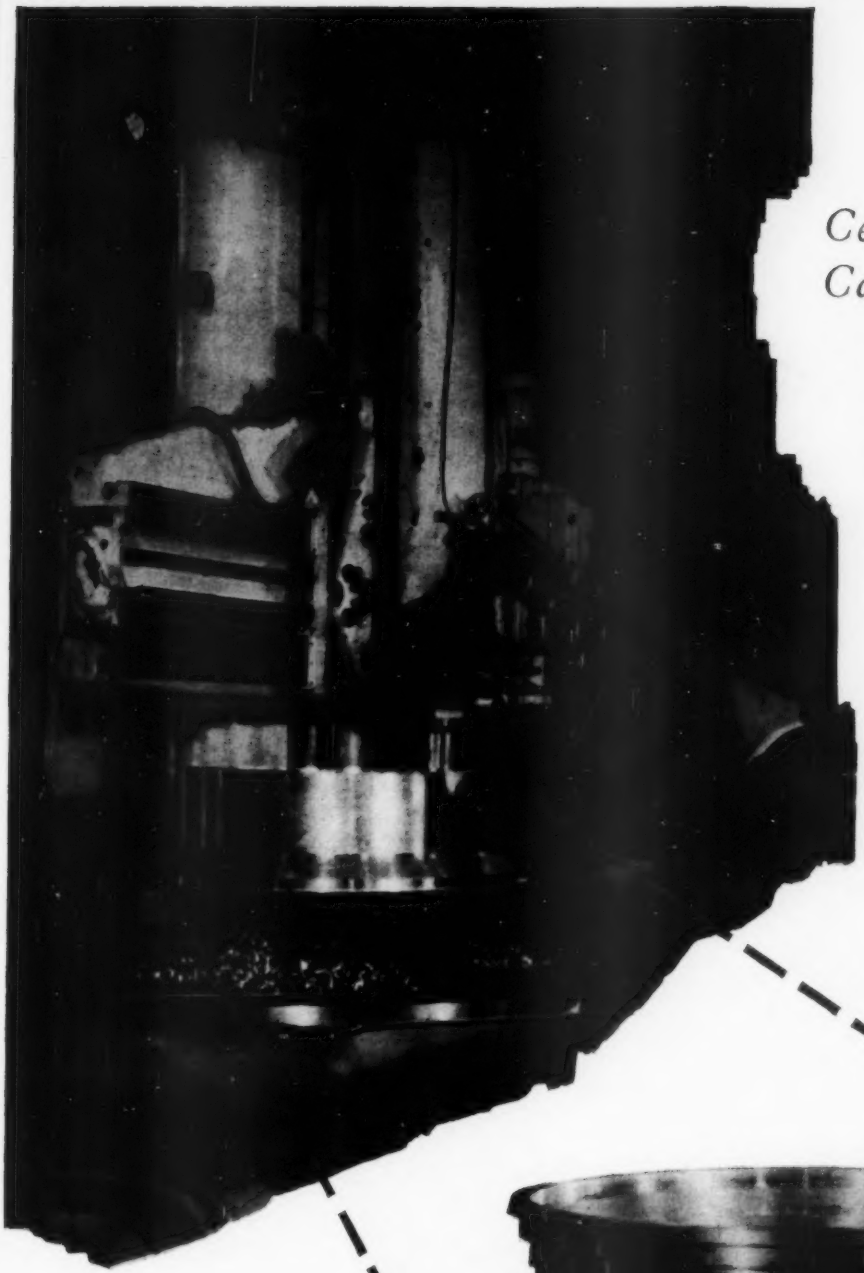
Ask for details of **'Daltolac' SF** and **'Suprasec' SF** for flexible foams and **'Daltolac' 21** and **'Suprasec' D** for rigid foams.

Enquiries should be addressed to: I.C.I. Sales Development Department (Polyisocyanates), Ship Canal House, King Street, Manchester 2.

IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON SW1 ENGLAND

D.879





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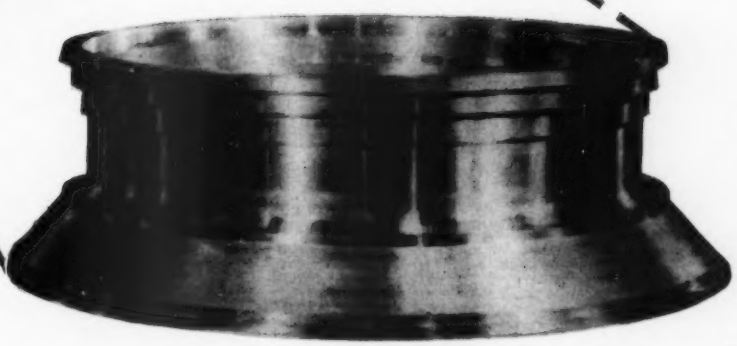

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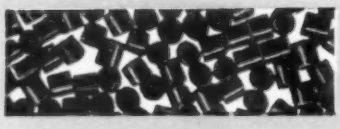

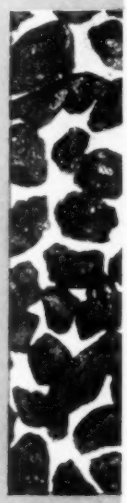

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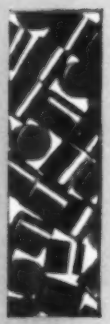

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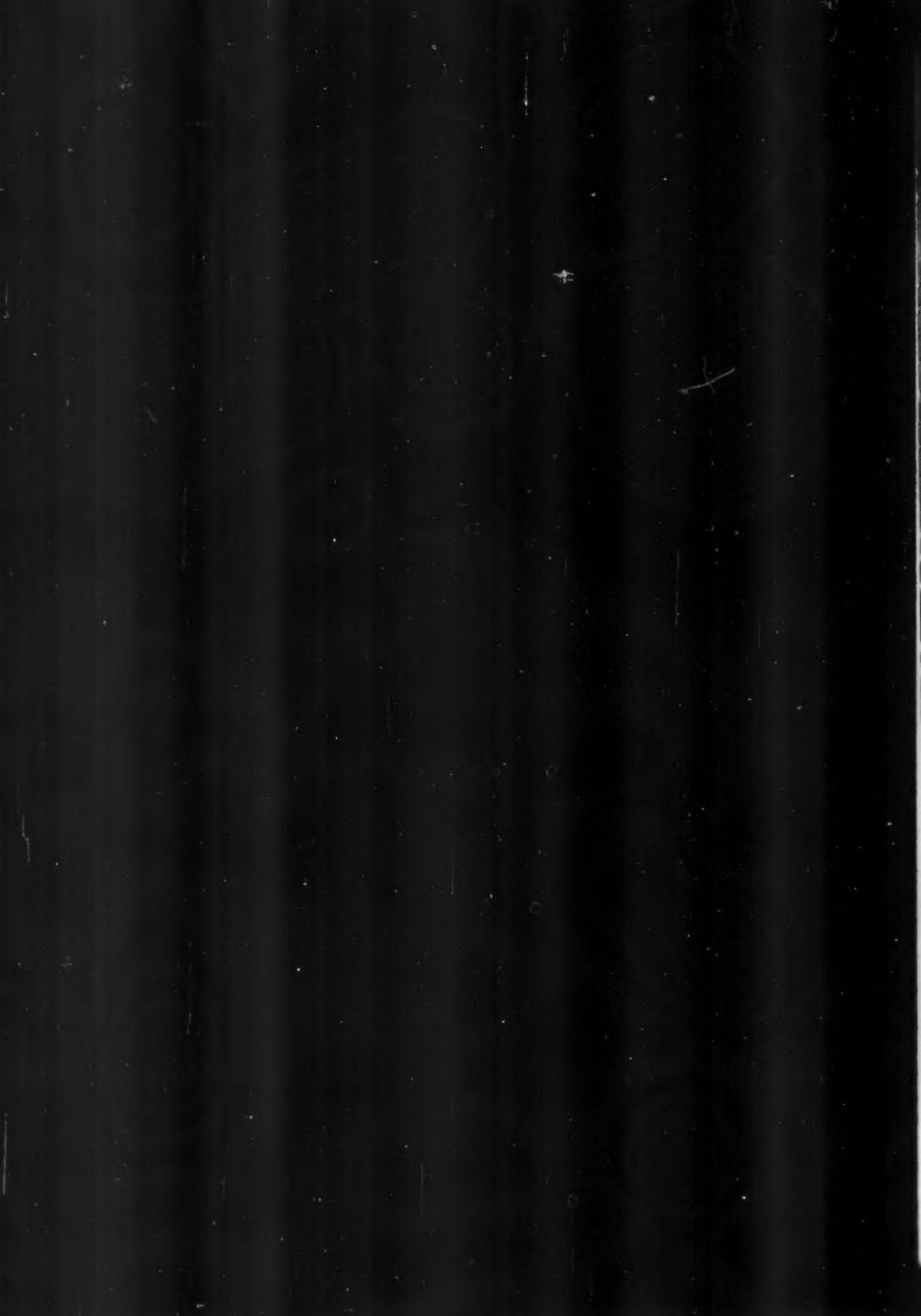

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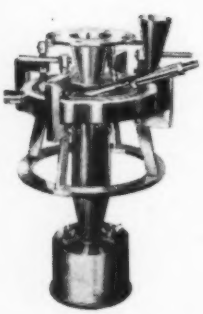

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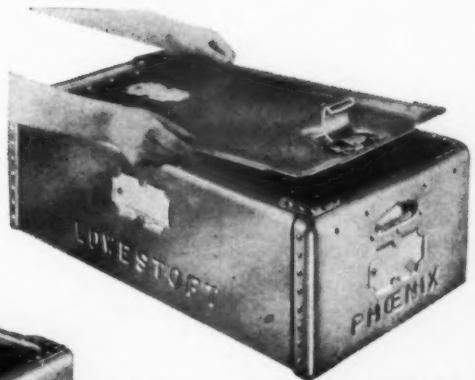

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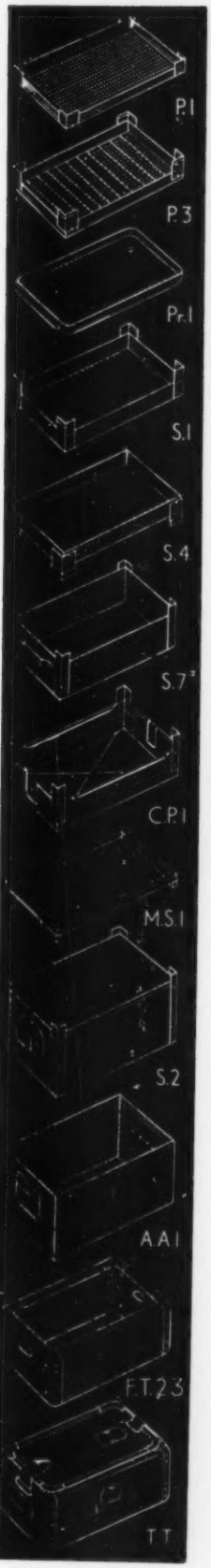

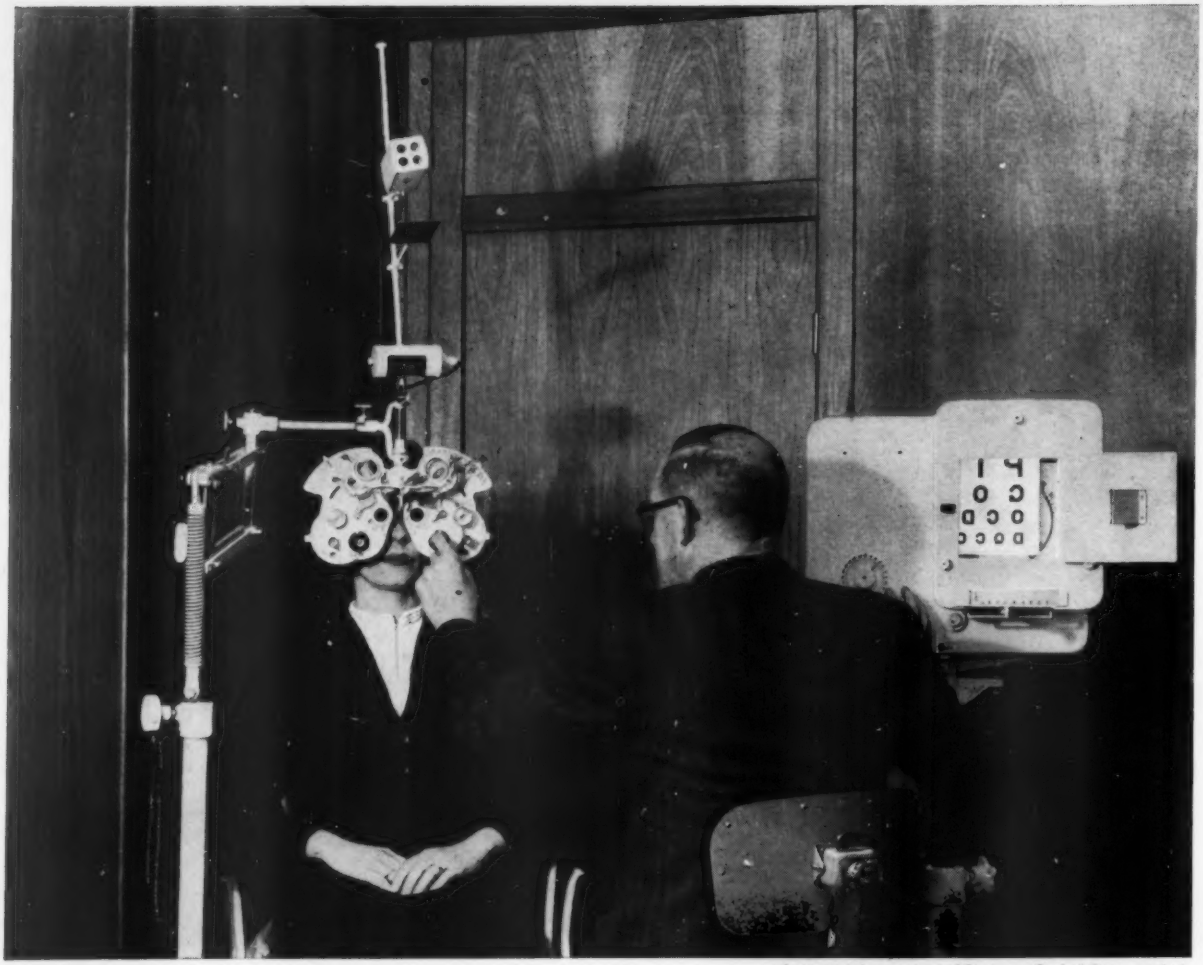

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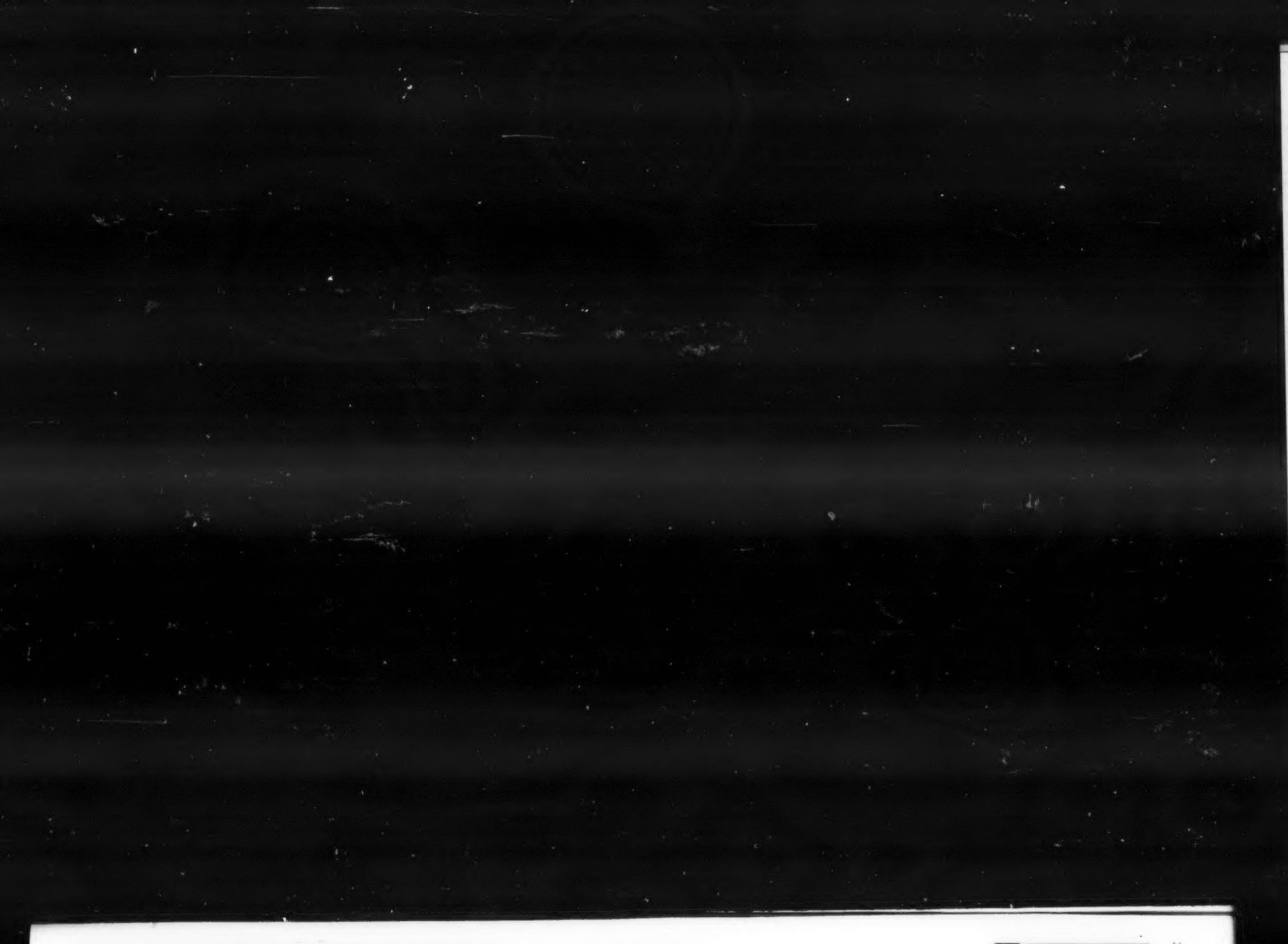

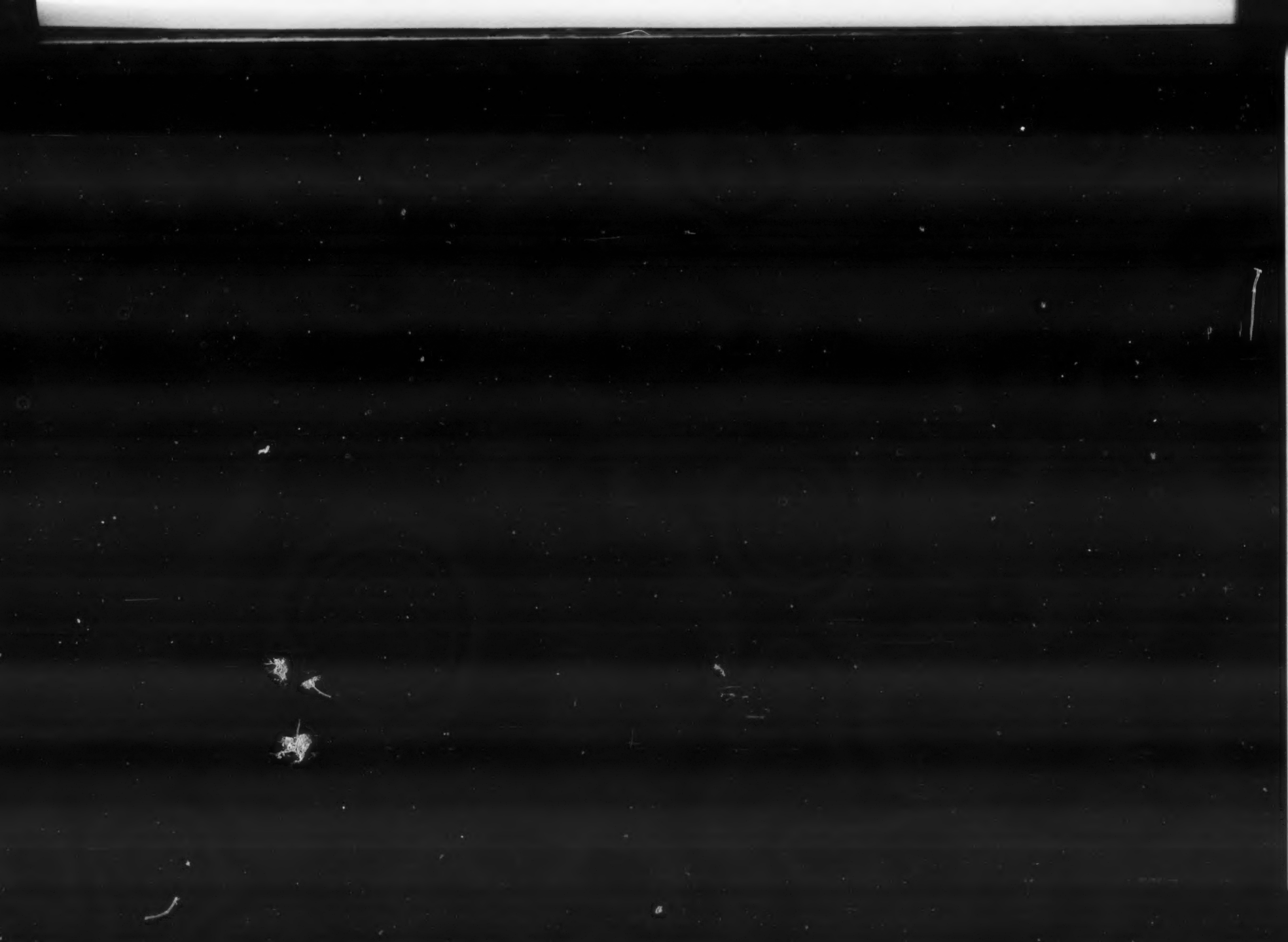

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FIRST[illegible]S WELL—STAYS FAST

A first class product deserves a first class pack. That is why many users of Trident vials, tubes and ampoules wisely specify labelling that is *fired on*. Glossy ceramic screen print preserves the natural lustre and transparency of glass, provides the perfect finish to the container. It is permanent too—will not fade, peel or wash off.

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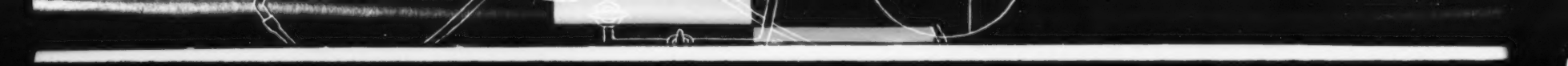

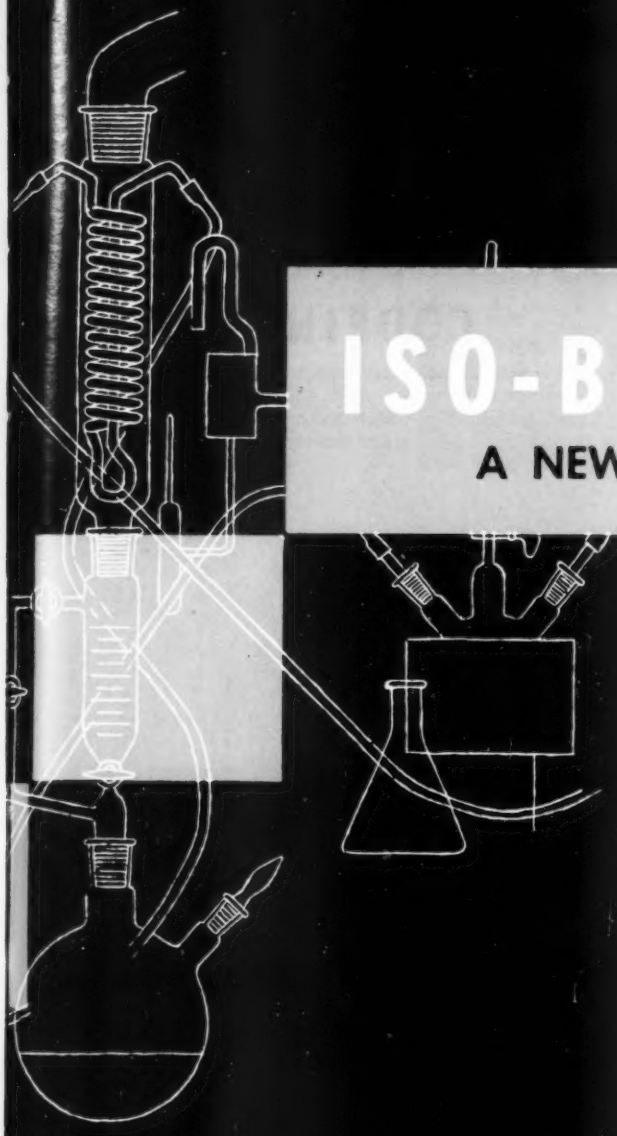

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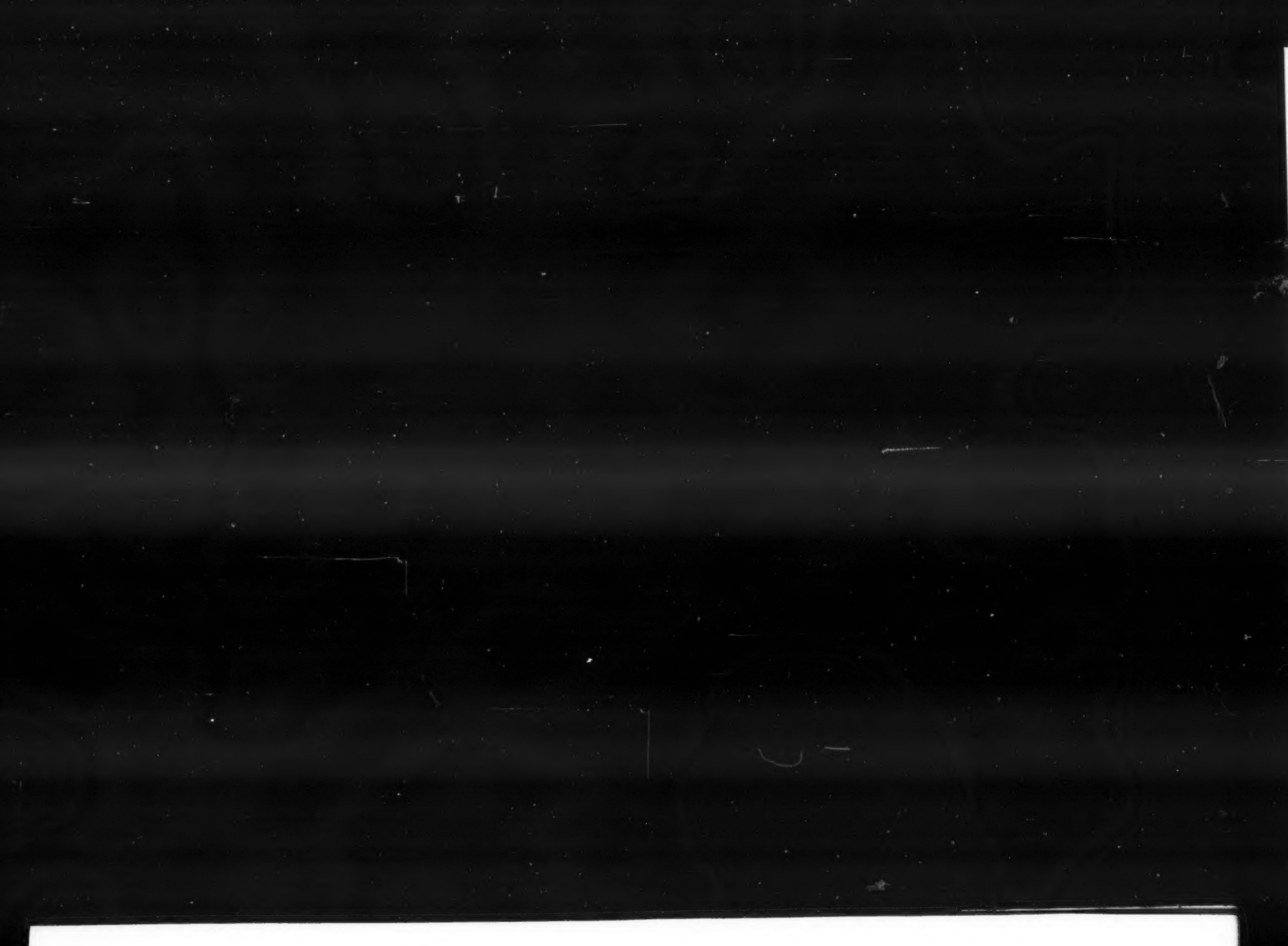

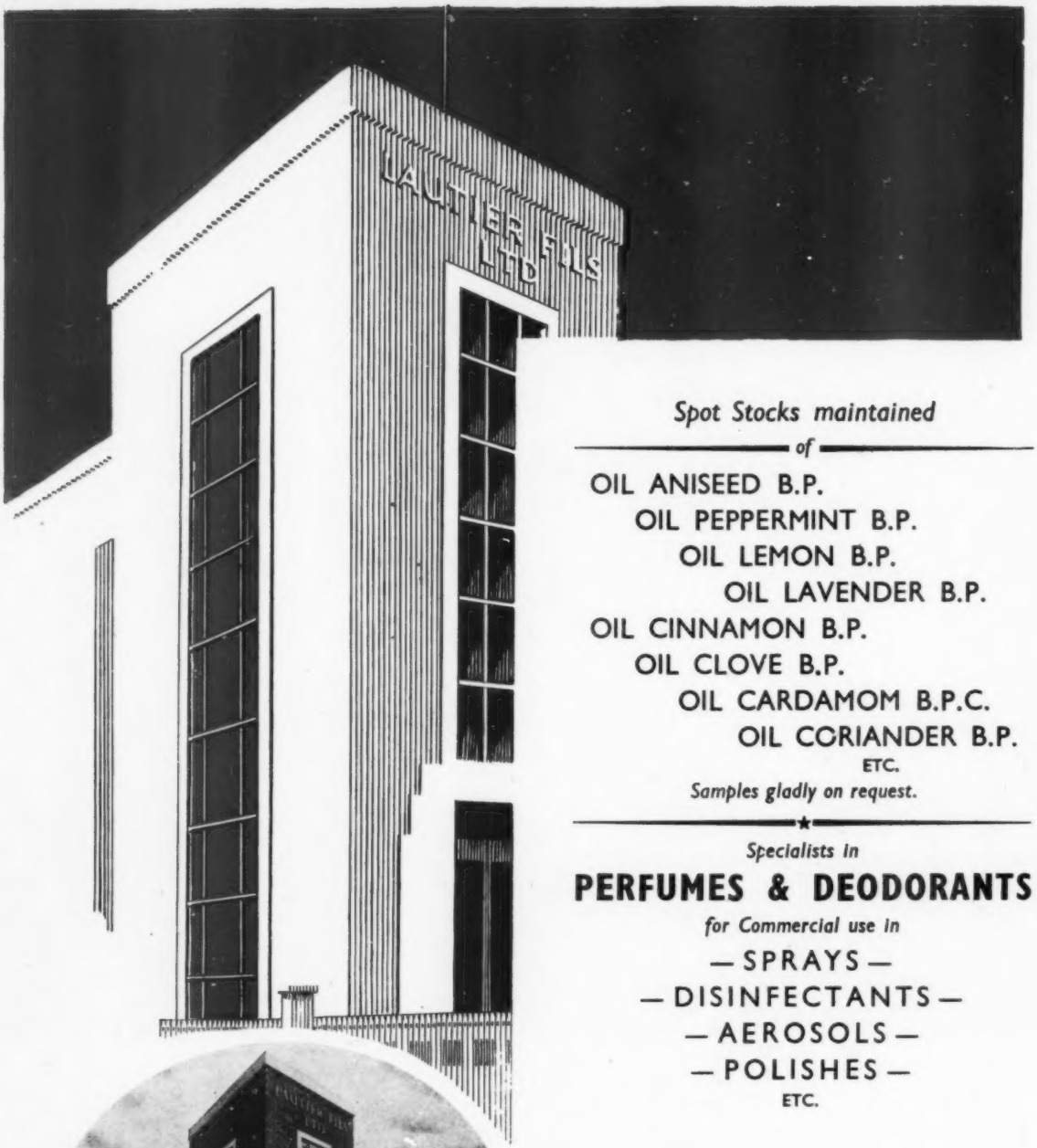

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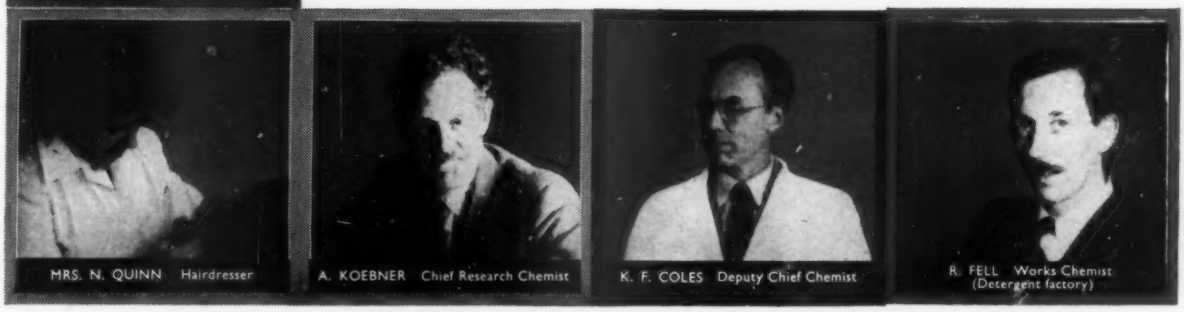

SALES SERVICE COMMITTEE

Of all the people concerned with the manufacture of Marchon detergent raw materials, here are 11 who are particularly important to our customers. Their complementary skills form the backbone of a Sales Service unique in the detergent field.

The high standing achieved by the products themselves is the result, first of an intimate knowledge of the problems—cost, performances, formulation, packing and shelf life—affecting the end-products; secondly of the availability of extensive research and test facilities. Through Sales Service the benefit of these resources is extended to our customers.

Manufacturers of:
Fatty Alcohol Sulphates (EMPICOLS),
Emulsifiers (EMPILANS),
Self-emulsifying waxes (EMPIWAXES),
Alkyl Aryl Sulphonates (NANSAS) and other detergent bases in powder, paste and liquid forms;
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Phosphoric acid and complex phosphates.

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FOAM STABILITY and DETERGENCY with

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Monoisopropanolamides

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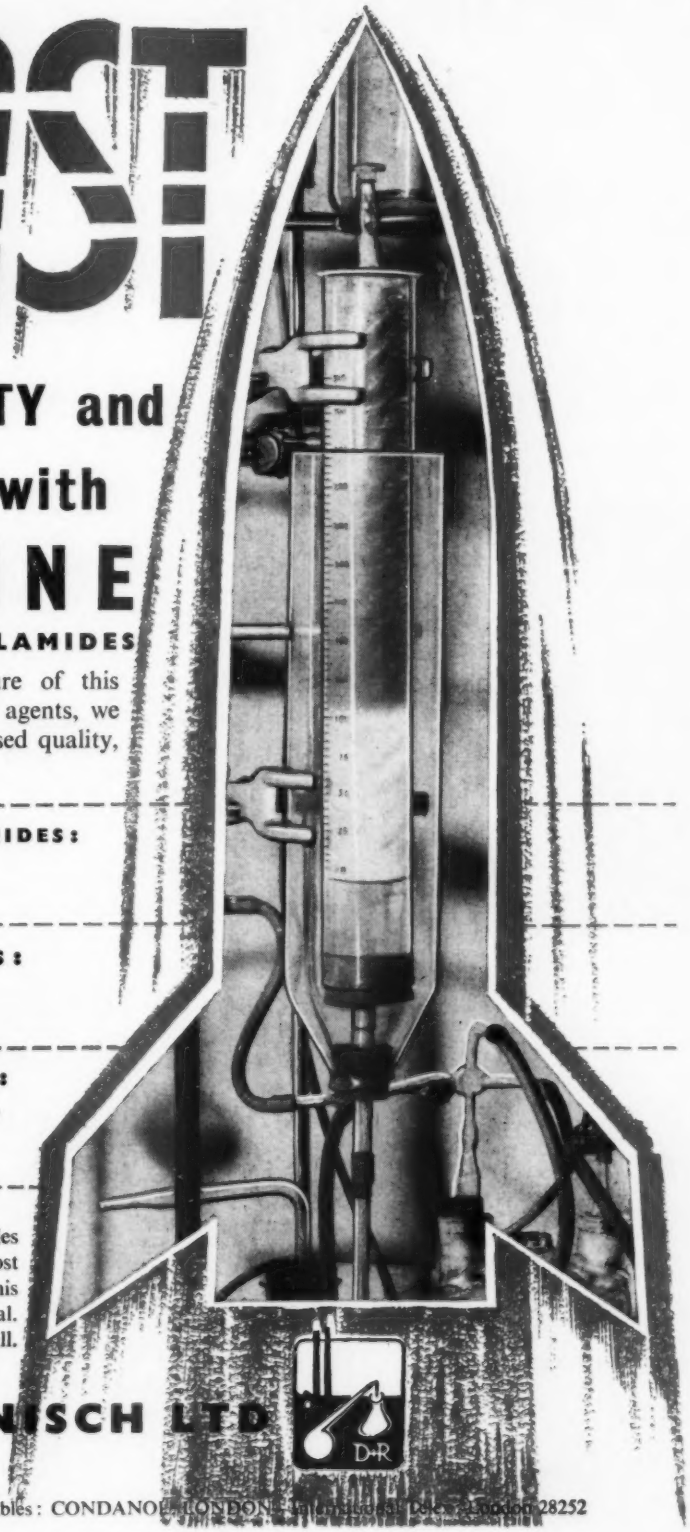
Complex Diethanolamides
'High Amide' Diethanolamides

SPECIALISED ALKYLOLAMIDES:

General cosmetic and lipstick qualities
Foam Bath Concentrates



Our British and Continental laboratories have been responsible for the most up-to-date research in this field. This experience is entirely at YOUR disposal. For further information, please write or call.

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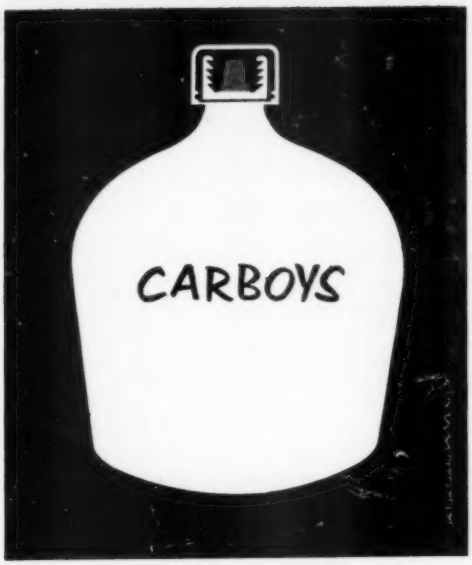
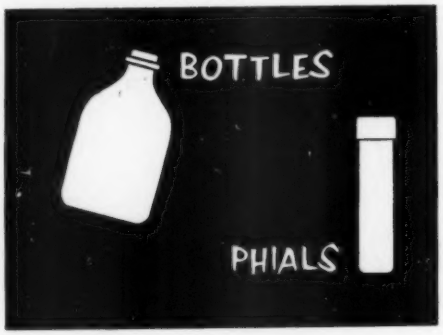
If the stuff has got any value SUBA-SEAL it in



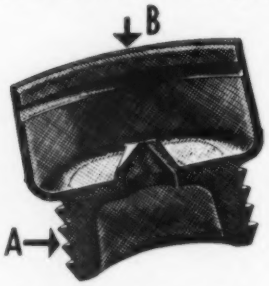
No liquid can get past a Suba-Seal closure. It's a suction seal; the annular serrations creating vacuum pockets which, incidentally, ensure the closure staying put.

There are two popular types; one, a turnover type which fits into the neck of the bottle and has a skirt top to pull over for double sealing; the other, is a cover cap with annular serrations on the inside, to grip the neck of the bottle from the outside. Both types can be supplied in sizes and materials for every purpose.



HOW IT WORKS

Insert portion (A) into neck of vessel and pull over skirt top (B).



TURNOVER TYPE

COVER CAP TYPE

★ *If it's a question of making leakproof and airtight any Bottle, Jar or similar container see . . .*

WILLIAM FREEMAN & COMPANY LIMITED

SUBA-SEAL WORKS, PEEL STREET, BARNSLEY

Tel: Barnsley 4081 Grams: 'Suba-Seal' Barnsley.

William Freeman's Technical Service will be happy to advise on all closure problems.

"Steady...
that's enough, thanks"

It is one thing knowing how much of a liquid you want. It may be another matter knowing where to get it.
When it's a question of ether and chloroform in quantity for industrial use, the source to rely on is the **M&B** range. The following are available:

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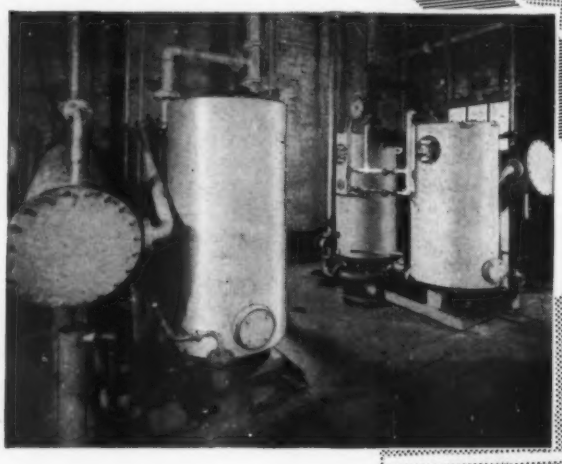
Drying Hydrogen for Carbide Tools



In the manufacture of Prolite tungsten-carbide tools, Murex Limited use Birlec adsorption dryers to remove water vapour from their electrolytic hydrogen supply.
The hydrogen is dried to a dew-point of minus 70°C for use in the reduction and sintering furnaces and the high quality of the product depends on the stringent moisture control.
Birlec moisture adsorbers are available in a range of standard sizes for varied industrial applications including the drying of compressed air and the dehumidification of factories and stores.

Illustration above:—
Birlec adsorbers for hydrogen drying.
Illustration right:—
Electrolytic hydrogen plant at Murex Limited.

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DRY AIR & GASES

DRYER DIVISION OF
BIRLEC LIMITED
An A.E.I. Company
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MANUFACTURING CHEMIST
and Manufacturing Perfumer

Vol. XXIX, No. 1 JANUARY, 1958

Contents

Topics and Comments: 1

Pesticides exhibition; How to get more engineers; Fresh start for tropical products research; Phenol from cumene; Nuclear magnetic resonance; Fresh views on fresh air; The green cross; Nitrogen for industry; Noise abatement

Instrumentation in a Small Fine Chemical Works 5

By D. E. B. Greensmith, B.SC., M.I.CHEM.E., F.R.I.C.

Flow Measurement in the Chemical Industry 9

New Instruments and Apparatus 15

The Synthesis of 2-deoxy-D-ribose 21

By Greville Machell, B.SC., PH.D., A.R.I.C.

Photographic Film Research 25

Progress Reports:

Perfumery and Essential Oils 28

By G. B. Pickering, M.A., D.PHIL., A.R.I.C.

Pest Control Chemicals 32

By D. P. Hopkins, B.SC., F.R.I.C.

Bigger Plant for Silicates Production 36

REGULAR FEATURES: BOOKS 34 • PLANT AND EQUIPMENT 35 • NEWS 38 • PEOPLE 41 MEETINGS 42 • NEWS FROM ABROAD 43 • CHEMICAL MARKET 44 • TRADE MARKS 46 NEW COMPANIES 46 • NEW PATENTS 46 • SIXTY YEARS AGO 46

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Wood engraving by John Farleigh

Best-seller in Bamboo

AFTER BEING SHIPWRECKED on the first of his three voyages round the world, Captain William Dampier found himself, in May 1681, fighting his way across the Darien Peninsula. Through mosquito-clouded forests and crocodile-infested swamps, the doughty captain, who was diarist as well as discoverer, clung to his one possession—a length of bamboo. "Foreseeing a Necessity of wading Rivers," he relates, "I took care before I left the ship to provide myself with a large Joint of Bamboo, which I stopt at both Ends with Wax. In this I preserv'd my Journal and other Writings, tho' I was often forced to swim." Deservedly, the Dampier Diaries proved to be best-sellers.

Foreseeing the necessity for protecting their merchandise on the highways and the seaways of the world, modern manufacturers take care to use cartons of 'Thames Board', and 'Fiberite' cases in solid or in corrugated fibreboard. These are fitting protection for products that deserve to be best-sellers.

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TOPICS AND COMMENTS

Pesticides exhibition

PREPARATIONS are well advanced for the Crop Protection and Pest Control Exhibition which the Leonard Hill Group is staging at the Royal Horticultural Society's New Hall, Westminster, London, from May 12 to 15. The exhibition is being organised by *World Crops*, the international journal of agriculture, in the same way as the successful Corrosion Exhibition was organised by *Corrosion Technology*.

The object of the exhibition, which has already obtained the support of leading manufacturers of crop protection products, is to demonstrate the latest methods and techniques for controlling pests and weeds in agriculture and horticulture. But attention will also be paid to domestic and industrial pests. Warehouse pests will be dealt with and rodent control and other public health matters will fall within its scope. The support of a number of associations and Government departments concerned with pesticides is being invited.

Many thousands of invitations are being sent to agriculturists and others overseas and it is confidently expected that the event will stimulate the export of British agricultural chemicals and pesticides, together with equipment for their application. The Exhibition will be open to the general public as well as to farmers, market gardeners, agricultural merchants, and horticultural and agricultural scientists.

Full details of stand bookings and related matters are available from the Exhibition Organiser, *World Crops*, Leonard Hill House, Eden Street, London, N.W.1, telephone Euston 5911.

How to get more engineers

IF BRITAIN was producing professional engineers at the same rate as Russia we would be producing about 15,000 a year; instead we train only about one-third of that figure. This indictment of British backwardness in training engineers (and other scientists and technologists) was delivered by Prof. Giffen, Professor of Civil and Mechanical Engineering at Queen Mary College, University of London, when he attended a prizegiving ceremony at British Oxygen Gases Ltd. He thinks that one remedy we might adopt is to encourage women to take up engineering; in Russia apparently 50% of the engineering students are women (Prof. Giffen led a delegation to the U.S.S.R. in 1956 to study engineering education.)

There is no reason at all why women should not make perfectly good engineers and chemists too, for that matter. The trouble is that the human race is shackled by the primitive means it has of propagating itself, which forces women to become wives and mothers. Apparently Russia has overcome this difficulty by fostering the breed of domestic servants, which is practically extinct in this country. Provide mothers with nurses and maidservants and, above all, the salaries to pay them, and the idea of women engineers and scientists becomes feasible.

Of course it is in matters of pay that the root of the problem lies. In Russia engineers and scientists are socially desirable; this is proved in the only way that matters, by paying them well. An engineering professor can be more highly paid than the director of a large factory. When we decide that this is the right pattern of rewards we shall get our engineers, male and female.

Fresh start for tropical products research

THE FIRST major removal from the Imperial Institute building in South Kensington to make way for its demolition began last month when the Colonial Products Laboratory moved to new premises in Gray's Inn Road, London. This move brought to an end the working life of laboratories built in the reign of Queen Victoria which, for over 60 years, have been devoted to the service of British Commonwealth, and latterly, more particularly, colonial territories. The name of the organisation is also being changed to the Tropical Products Institute in anticipation of its function broadening again to that of assisting and advising territories in tropical and sub-tropical regions which are not necessarily colonies, the countries which have recently acquired independence within the Commonwealth being particularly in mind. The Institute will, of course, continue its work on behalf of all colonial territories, tropical, sub-tropical and temperate.

The building which will accommodate the Tropical Products Institute was erected in 1955 on a bombed site opposite Gray's Inn, but was not originally intended for use as laboratories. It has, however, been adapted by the Ministry of Works to provide the Institute with 44,000 sq. ft. of modern accommodation. In addition to a basement, which will provide storage space, the building has seven floors above ground, laboratories being distributed on all but the uppermost.

Eight self-contained laboratories will be devoted to advisory and investigational work on the main groups of plant and animal products of the tropics. Among them is a paper-making laboratory, and six other laboratories will conduct rather more fundamental research on topics which have a bearing on the needs and problems of tropical and sub-tropical areas; another six laboratories will provide general supporting facilities such as the physical

chemistry suite of rooms, the chromatography laboratories, and the sample grinding room. There will also be a pilot plant laboratory and a workshop.

The laboratories together contain a ¼ mile of benches which will provide good average working space for the 75 laboratory workers that the Institute will have on its staff when it reaches full complement. Some bench space will be devoted to training overseas students and to other visiting workers. All laboratories are equipped with the usual modern services and have forced extract ventilation and fluorescent lighting; much of the furniture and fittings has been specially designed.

The Institute possesses a library of some 150,000 items which constitutes a unique collection of information on tropical plant and animal products, and of the agriculture and production of the Commonwealth. General scientific, technological and trade information is also available. This library will be housed in two large rooms, one of which will be open to the public for reference purposes on Mondays to Fridays between 10 a.m. and 5 p.m. The building has a small museum and a conference room which will also be used for lectures and showing films. The total staff of the Institute will eventually be about 150.

Phenol from cumene

THE cumene oxidation process for phenol production, which is based entirely on coal and oil chemicals, is to be utilised in a new plant which British Hydrocarbon Chemicals Ltd. is to build at Grangemouth, Scotland. With the plant now being built there for the manufacture of high-density polyethylene, the total cost of the new projects at Grangemouth is £8 million, bringing the company's investment there to £25 million.

The Distillers Co., one of B.H.C.'s parent companies (the other is British Petroleum), had the cumene oxidation process ready at least five years ago. They have since worked on it at their Epsom laboratories and at a pilot plant in Tonbridge, Kent. But ample evidence of its performance under full-scale operating conditions has been forthcoming from abroad, the company having licensed the process to companies in the U.S., Belgium, Canada, France, Germany and Japan. Indeed it has been used in almost all the big new phenol plants which have been built in the past five years, and all expectations of its economy in operation and of the quality of its products have been fully realised.

All previous processes for the manufacture of synthetic phenol have required the use of large quantities of sulphuric acid or chlorine. Since neither of these forms part of the final product these chemicals either were wasted or had to be recovered at some expense. In the new process neither is used. Instead, benzene is first made to combine with propylene to form cumene (isopropyl benzene), which is then oxidised catalytically to phenol and acetone. Both end products can be separated relatively easily in a high degree of purity and the whole plant can be run with a high degree of automatic control so that labour requirements are very small. At Grangemouth an increased supply of propylene has been provided for with the construction of a second petroleum cracking unit. Coal tar benzene is already used there in large quantities for making styrene monomer and detergent alkylate.

The first publication relating to the preparation of cumene hydroperoxide and its subsequent cleavage to yield phenol and acetone occurred as a result of German work. Hercules Powder Co. in the U.S. and Distillers here, both of whom had already been carrying on research into the oxidation of hydrocarbons, took up the work quite independently and developed attractive large-scale processes.

The Grangemouth plant, which is due to be finished in about eighteen months, has been planned to take advantage of the growing demand both for phenol and acetone.

Nuclear magnetic resonance

NUCLEAR magnetic resonance, the name for a method of identifying atoms and determining their distribution in molecular structures, was the subject of a two-day conference held in New York recently under the auspices of the New York Academy of Sciences. Physicists and chemists of Canada, England and the United States took part.

N.M.R. is already employed in the chemical and petrochemical industries, and new uses are being found for it in atomic engineering and other fields where the components of substances or the structure of their molecules are important.

The principle of N.M.R. depends on two characteristics of atomic nuclei which have been recognised for decades: (1) They spin, like a top or gyroscope. (2) Almost all (approximately 100) of them are magnets, like infinitely small bar magnets.

The ratio between these two qualities is distinctive for each atom, and can be measured by introduction of the factor of resonance. This is done by placing a sample of the substance to be analysed between the poles of a magnet and sending through the sample low-power radio waves. The radio waves are picked up and recorded. The record pictures the " profile "—unique for each atom in any molecular structure. This is true even for those atoms which are not magnetic. The stable, or normal, form of oxygen is one of these. Though it does not itself appear on the oscillograph record, this oxygen so modifies the profile of the atom or atoms to which it is bound, and which are in its vicinity, in the molecule that its presence and relative proportion are shown.

So important is this tool to science that its discoverers were awarded the 1952 Nobel prize in physics. They are two professors, Dr. Felix Bloch of Stanford and Dr. E. M. Purcell of Harvard, in whose laboratories nuclear magnetic resonance was first measured—independently—in 1946.

Fresh views on fresh air

In Los Angeles the public has recently been presented with a new product, tins bearing a neat label " This is the Smog used by famous film stars . . . No pollutants or irritants removed." The canner is the Los Angeles Smog Corporation, which proclaims itself to be more interested in making a complaint than a profit. Smog is an increasingly serious nuisance since the city's industries began to spread and the density of motor-car traffic has risen. Air pollution is indeed the curse of modern industrial civilisation; it is incredible that, after all that has been done to render pure the people's water and food, we still tolerate the poisoning of our lungs with the choking effluents of factories, cars, railways and domestic fires. The intensity of feeling which this neglect has aroused may be judged from the conclusions of a conference held recently in Milan; this conference emphatically declared the right of people everywhere to breathe fresh unpolluted air. It was convened by the World Health Organisation and was attended by representatives of 21 European countries, including, among the British delegates, the former Chief Alkali Inspector, Mr. W. A. Damon.

The conference brought to light some shocking facts. In Yugoslavia the village of Rudare is being depopulated owing to the rate of animal mortality caused by foul air. In the Netherlands, that country which is so proud of its farming, fluorine pollution is killing cattle and withering flowers and vegetables. In Sweden harmful effects on plant life have been observed as a consequence of flue gases from shale oil factories, phosphate factories, carbon bisulphide plants, copper works and electrochemical factories. And, of course, we should not forget the Thames Valley smog disaster of December 5-8, 1952, which killed some 3,500 Londoners.

Of course it is not just chemical works or, indeed, industry generally that are responsible. In Paris, for instance, it is reckoned that motor traffic causes 30-40% of the total pollution and domestic heating about 50%.

Among the main conclusions of the WHO conference were that the Organisation should provide a clearing house for air pollution information, that countries that have not yet done so should set up a national advisory body on air pollution, that basic sampling and measuring methods and apparatus should be standardised internationally, and that anti-pollution training schemes should be devised and used.

These are fine ideas, but will they be applied? Are the delegates who attended the conference sufficiently influential to ram home the need for action to their respective governments? Indeed, is WHO itself influential enough to be more than the generator of pious hopes? Really it is not a matter for governments. Everyone—factory owner, householder and car owner—should resolve now to stop being public nuisances, to stop regarding the air as a dustbin.

The green cross

A campaign to minimise the number of industrial accidents has been launched by the British Standards Institution, whose recommendations, " Safety Colours for use in Industry," have just been published.

The purpose of these recommendations is to establish throughout industry the use of a universal system of colours for the identification of hazards and safety equipment. Such a system is in substantial agreement with the code of safety colours shortly to be recommended for world-wide adoption by the International Organisation for Standardisation. On this international basis, the mental association of colours and signs with particular types of hazard will not be upset by workers moving from one country to another.

The three main colours are green, orange-yellow and red, but contrast and geometrical forms should be used where necessary, as patterned surfaces can be detected by those employees who are colour-blind.

The use of a green cross in place of the familiar red one, for instance on first-aid cabinets, is a break in tradition agreed on by the committee who drafted the Standard, since green is in line with the international code and because it is already associated in the public mind with safety. Green will also be used for escape routes and for safety equipment such as eye-wash bottles.

Red will mean " stop " for use near dangerous areas. Red with a white chequered pattern will be used for the door of a store containing explosives or other dangerous substances. Another example of this red and white contrast will be for barricades and obstructions.

On the other hand, fire fighting equipment and lettering for fire exits, indications of safety, are to remain red. One might comment here on a lack of logic, but it has been pointed out that a changeover was attempted some years ago in America when this idea of green fire-fighting equipment was tried. Even fire engines were painted green for the sake of conformity, but the public outcry was reputedly so great that this venture had to be abandoned. As far as the lettering for fire exits is concerned the Factory Act of 1937 specifies the use of red.

Orange-yellow, with black contrast stripes where practicable, will give warning of danger arising from changes in floor levels and similar tripping hazards, low headroom due to structure or pipes, and machinery guards.

The B.S.I. emphasises that these safety colours are not intended as substitutes for proper accident prevention.

The committee which drafted B.S. 2929 is widely representative of industry and includes the Association of British Chemical Manufacturers.

Copies of the Standard are available from the Sales Branch of the Institution, 2 Park Street, London, W.1, price 4s. 6d.

Nitrogen for industry

O.E.E.C. Project No. 371 was a mission by six technicians to study industrial uses of nitrogen in the U.S. The report* is yet another fine piece of documentation, packed with data and detailed information. O.E.E.C. countries, traditionally exporters of nitrogen, are right to be concerned about the future outlook of the world nitrogen market; old and new production centres are combining to outstrip demand from "normal" uses. The higher proportion of nitrogen used in U.S. industry and *not* as fertiliser—25-30% as against a proportion of 12-15% in Europe—suggests that America has something to teach Europe about nitrogen marketing. Undoubtedly this was confirmed by the mission of six; the account of U.S. technical sales-promotion methods is first-class and stimulating, and it applies to chemical products widely, not merely to nitrogen. However, when the end of the report is reached, it becomes clear that U.S. nitrogen producers enjoy an advantage that is unlikely to be enjoyed in Europe. Obviously, it is easier to develop new markets for a basic chemical material when it can be produced at exceptionally low prices.

Cheap natural gas in the U.S. is the basic difference. This raw material for ammonia synthesis is five times dearer in Belgium, four and a half times dearer in France and one and a half times dearer in Sweden. The U.S. producer can start off cheaply and then, with an expanding market, costs can be still further reduced by "mass-production" advantages. Thus, plant maintenance costs are estimated at half of those in Europe—due mainly to the fact that the plants in America are about twice as large. Productivity on a man-power basis is higher in the U.S. but this is cancelled out by the higher price of American labour, a point that has emerged before in other U.S.-European chemical costs comparisons.

The higher proportional industrial use of nitrogen in U.S. is not due to the fact that in Europe nitrogen fertiliser rates of use per acre are much higher. Worked out *per capita*, U.S. fertiliser use is in fact higher. Industrial uses that are exceptionally developed in America are in synthetic fibres, plastics, metallurgy, oil refining, explosives and paper. The ammonia process for wood pulp is being increasingly used instead of the sulphite process—but, again, the point of price cannot be evaded in any argument that Europe could do likewise. The use of urea as a feed for ruminant animals is another impressive U.S. development. 70,000 tons are already used per year, which is about 15% of total production. The economic basis of this use for urea is that it is cheaper than equivalent protein nitrogen in normal feedstuffs. Feeding urea to cattle must be done carefully; the economy offered has to be attractive to make it worth the care and the risks of error. The U.S. development has needed vigorous marketing, but would not even more vigoro··· marketing in Europe be needed to achieve much less with urea at a higher price?

It seems likely that this publication will be of more value as an exceptionally fine document of reference than for its avowed purpose. It should certainly be thoroughly studied. The members of the mission—from France, Sweden and Belgium—are to be congratulated for unhesitatingly using published data or estimates to fill gaps in the picture they were able to draw for themselves; for this purpose, trade-technical journals have been relied upon a great deal.

* "Industrial Uses of Nitrogen." 1957, O.E.E.C., pp. 136. 18s. or $2.

Noise abatement

MANY factories are inherently noisy and it is extraordinary that in them workers do their jobs with apparent ease. In spite of their outward oblivion of their surroundings, however, it is now known that detrimental effects such as nervous fatigue and even partial deafness are attributable to continual excessive noise in industry.

In view of the effect on the worker and consequently on production it is in the interests of managements to prevent noise wherever possible and in other cases to reduce it to a satisfactory level. The machines themselves are a target for research, and techniques for the minimising of noisy and vibrating machinery should be borne in mind during their design.

Conveyors are often the noisiest equipment in a factory. Firms with this problem will be interested in the way Petfoods Ltd. have reduced this noise. Their main intake conveyor is in operation round the clock. The first part of its length is enclosed in an asbestos and steel frame tunnel which bridges the main works road between the reception centre and the main building. This is a distance of some 700 ft. over which empty cans travel very quickly along three lines of traffic according to their size. So that a continuous delivery of cans could be maintained they had to be over-fed at the loading end, leading to alternate bottling up and release of pressure. This resulted in workers in some sections of the conveyor being subjected to stress due to excessive noise.

The first step in dealing with this problem was to line the floor of the covered-in section of the conveyor with asbestos board and glass wool, so reducing the sound level by about 11 decibels. From the roof of the tunnel were suspended heavy, quilted, asbestos-filled pads or mattresses which, spaced across the flow of traffic at 18 in. intervals, reduced the noise level by a further 8 decibels. More improvements were made with the installation of a half-box of suitable boarding material in the processing and canning department, where a small section of about 12 ft. passed over the quality control inspectors. The main office of the factory has also been specially treated to reduce noise. The floor is carpeted.

Instrumentation in a Small Fine Chemical Works

By D. E. B. Greensmith, B.SC., M.I.CHEM.E., F.R.I.C.*

Instrumentation is not a luxury which can be afforded only by the biggest manufacturers operating large plants and factories. In this article the author shows how simple but well planned instrumentation has improved the efficiency and productivity of a fine chemicals factory employing only 25 people but operating 40 processes.

THE PRODUCTION of fine chemicals has its own particular problems, often associated with the high cost of the individual product and with the small batch sizes which are normally required. Continuous processes are only infrequently encountered and the highly-developed instrumentation methods associated with continuous production therefore very rarely apply. At the same time, fine chemicals production can benefit very effectively from the use of instrumentation, tailored to suit the requirements of this type of work.

The big chemical manufacturers are already experts in the art and science of using instruments on their processes. In fact, the application of automatic methods is one of the reasons for the growth and prosperity of these companies. The small organisation can also profitably employ instruments. Many small organisations are already converted to the idea of installing recording and controlling equipment wherever possible, but there are also companies which hesitate to take advantage of modern techniques because they feel they are perhaps too small or inadequately staffed to benefit from these modern methods. This article takes as its basis a small chemicals-producing unit which operates as a service unit to a pharmaceuticals factory and also partially as a producer in its own right. The range and type of instruments which can profitably be used is therefore restricted, and the instances quoted may appear very elementary to those who normally think in terms of control rooms and extensive graphic panels. In spite of this, a great deal of assistance has been gained from the use of simple automatic controls which do not require complicated installation or maintenance.

The unit is separated from the parent factory and manages its own design, erection and maintenance. Approximately 40 different chemical processes are operated during the course of a year, resulting in the synthesis of twelve different finished products, and therefore, versatility must be one of the aims of design. The quantity of each finished product varies from approximately a hundred to a few thousand pounds per year and the value from a few shillings per lb. for the cheaper intermediates up to £50 per lb. for some finished products. The whole manufacturing effort of the works, therefore, is unsuitable for the installation of complicated control systems, in spite of the fact that the variety of products and the small quantity of each product made results in a high labour content in the finished cost.

Some 25 people work on the site and no instrument fitter is employed or is available locally. Faults which cannot be readily diagnosed and corrected on the spot are dealt with by the maintenance organisation of the manufacturer of the instrument concerned.

Here are examples of the instrumentation employed:

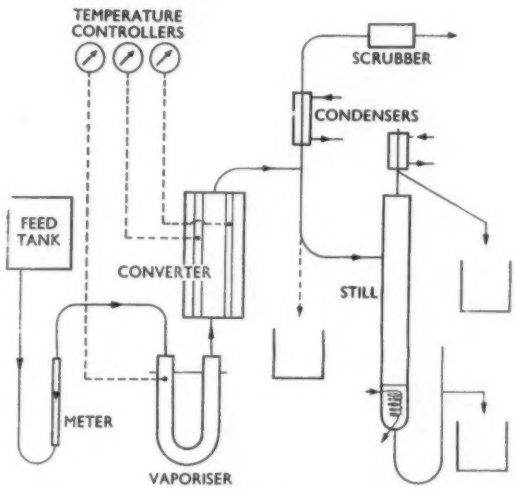


Fig. 1. Flow sheet of vapour-phase catalytic process.

Batch nitration

The first example, which is one of process improvement, relates to a batch nitration process. As in all nitration processes there is a large heat release and the temperature of the reaction is important. Two reactants comprising 10 gal. in volume have to be added to the nitration mixture in a stream under manual control consecutively and in the minimum time compatible with maintaining the correct reaction temperature, full cooling being applied to reduce the addition period. 64,000 B.Th.U. have to be removed in 20 min. from a charge of approximately 40 gal.

The yields from the process varied erratically and it was obviously important to standardise this yield and maintain it as near as possible equal to the highest figures already obtained.

* Director of Production, Smith Kline and French Laboratories Ltd.

It seemed likely that the temperature conditions in the vessel were not being adequately shown by the bimetal dial-type thermometer used. A rapidly acting potentiometric temperature recorder operating on the resistance thermometer principle and using a low heat capacity sensitive element was installed. The strip chart was arranged for high-speed drive. At first it was used only to monitor production, but it was soon evident that the rapid response of the instrument was showing up hitherto unsuspected variations in temperature consequent on an unsteady reactant addition, which in turn was giving local high temperature in the mixture. It was quickly proved that a smooth temperature curve on the record chart resulted in a high yield and that a wavy line was evidence for expecting a lower yield. Additions carried out manually using the recorder as the guide resulted in high and consistent yields.

It is obvious that the information supplied by the instrument could have been suspected without its use, but it was the visual evidence of the charts and the repeated comparison of the curves recorded which gave the proof and the information on which to base current practice.

As a consequence the yield on this particular process has been improved by 5%. The cost of the instrument, including installation, was just under £300, while the saving in one year resultant from a 5% increase of efficiency in this one process has been rather over £600.

The instrument therefore paid for itself during half a year's production. It continues in use on this nitration process, which is a seasonal one, as required, but in addition it has been fitted with a selector switch so that the production conditions in any of the reaction vessels in this particular building can be recorded as required, either in the course of normal production or for purposes of process investigation. The speed of drive of the recording chart is easily adjusted to suit the needs of the particular process by changing the driving gear wheels.

The manner in which this instrument has been installed to record the temperatures in several reactors at will is in keeping with the need for versatility already mentioned. The process improvement in the production of the one intermediate consequent on the use of this instrument has been shown, but its value is obviously not limited to the one case. Again, because of the number of new processes continually being investigated in the course of varying requirements for new drugs, the possession of such an instrument giving a graphic record of process conditions is invaluable for process development. It is a particular asset in this type of manufacture where requirements for quantities of individual chemicals are always small and optimum conditions must be realised very rapidly, very often there being no later very large production to recoup extensive development costs.

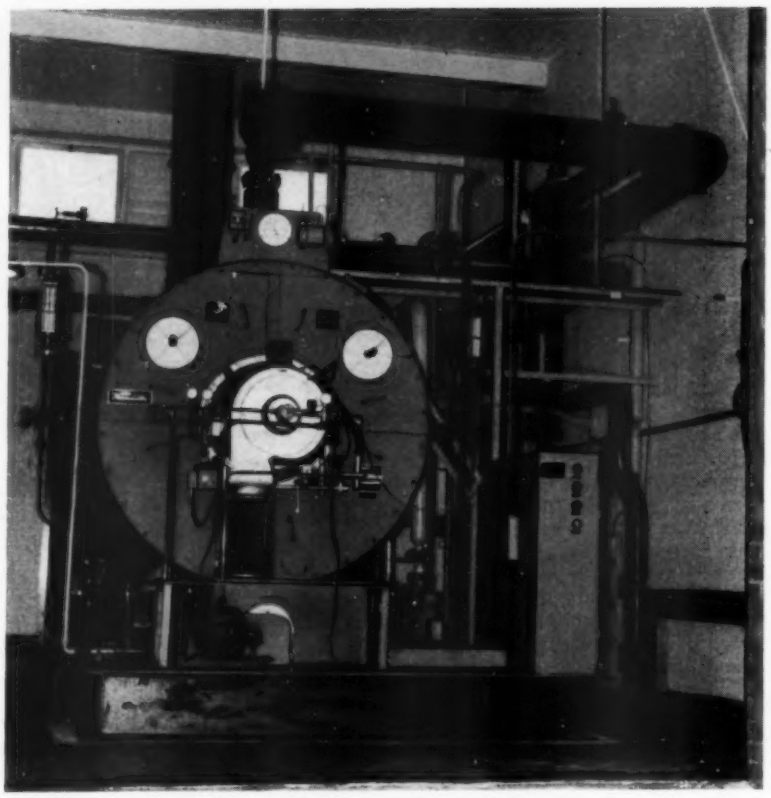


Fig. 2. Packaged boiler with its instrumentation.

Vapour phase catalysis

The second example relates to a vapour-phase catalytic process which could not have been operated without the use of instruments.

It consists of a permanent plant installation in which a solution is fed through a manually set valve via a float type flow meter to an induction-heated vaporiser. The vapour resulting passes through a multitubular converter containing catalyst also heated by induction. The product passes to a condenser where the majority condenses and falls out to a continuously-operating glass distillation unit while non-condensibles are scrubbed by a small electrostatic precipitator. To indicate the scale of operation the feed rate to the vaporiser is 9 lb./hr. and the under flow from the glass still about 6 lb./hr. (Fig. 1.)

The instrumentation side consists of temperature controllers working off thermocouples sited in the vaporiser and in the converter banks. These control the power input to the induction heaters.

This plant, with the exception of the still, operates 24 hr./day, but is only attended during normal day work hours for product quality check and adjustment. The long operating periods are essential for good results as the unsteady conditions at start-up and shut-down result in deterioration of catalyst and the falling-off of conversion efficiencies. In this instance the complete control unit was made up by the manufacturer at his works in a transportable unit which was installed by the site personnel.

During operation of the process over a period of six years only one breakdown has been due to instrument failure and this was rapidly remedied by the visit of a maintenance fitter from the service department of the instrument manufacturer.

The fact that this type of production equipment can be satisfactorily installed and operated by a small works can make the difference between accepting and refusing business. It can also provide a link in the chain of a synthesis which might otherwise be missing.

Steam raising

The third example applies to the universal problem of steam raising.

There are on the market many excellent methods of making boiler plant fully automatic, as well as packaged boilers for the small steam consumer which are delivered on site fully instrumented and almost ready for starting up.

On the site under present consideration the small marine type, oil-fired, boiler of 1,100 lb./hr. steam capacity was fitted with automatic controls covering the steam pressure, the water level and flame failure. Extensions to the low level and flame failure indicator lights were carried through to the work-rooms to give a signal if the boiler required attention. No boiler man is employed and the operation of the boiler is the responsibility of a fitter, who carries out a daily instrument check at the same time as the normal blow-down procedure. At the same time one of the mates carries out the general cleaning and water softener regeneration as required. Normal labour requirement is of the order of 1 man hour/day.

Part of the value of this automatic control is in the saving in labour. If a boiler man was employed the extra cost of his wages, assuming one-third of his time was taken up with odd jobs not charged to steam raising, would be an extra charge of 2s./1,000 lb. steam on the present typical production of 200,000 lb. steam/month. Expressed in another way, this would be equivalent to a fall in boiler efficiency of 20%.

Included with the instruments on the boiler was a steam flow meter. Its record was of great assistance in planning production, as processes including distillations obviously have a much higher steam demand than those which merely require heating to start a reaction. As production requirements grew, the quantity of steam available became marginal and a very rough knowledge of the steam demand for each product allowed a programme to be made up which made the most of the capacity available. This scheduling, therefore, allowed production to continue at a high level while the planning and installation of extra steam-raising capacity was being carried out. This has now been completed, and Fig. 2 shows the new Powermaster boiler, an example of the packaged type of boiler mentioned above.

If necessary the steam record can also be used in the costing of any particular material, apart from showing, in conjunction with the fuel usage, whether the boiler efficiency is varying significantly due to scale formation, dirty smoke tubes or other causes.

Ventilation

There are also miscellaneous instances of help from instruments which cannot be easily evaluated.

Throughout the factory the ventilation extraction system in individual work rooms is linked electrically by means of a contactor with all electrically-powered moving or heating equipment. The intention here is that no operation can be carried out which will produce hazardous vapour—toxic, corrosive, or inflammable—unless the extraction is on. In the event of failure of the ventilation such processes would be automatically shut down. This is a system which has to be considered with great care, and its implications studied in detail before installation, as it is obvious that there are some processes where *more* ventilation might be required if, for example, stirring was suddenly stopped. Where helpful, the ventilation motor starter has been fitted with a time switch. As a consequence, if, for example, a process needs stirring until 10 p.m. the cutting-off of the ventilation by the switch at that preset time will shut down the stirrer and overtime is unnecessary.

Inevitably also as a result of this system a man has to switch on the ventilation before he is able to start his work in the morning. This has importance from the psychological point of view. Every morning the man is reminded by his action that the materials he is handling are not to be lightly regarded, and last thing every night as the ventilation is shut down the same point is emphasised.

As an extension to this principle, where possible, the electrical controls and other instruments are grouped together in a switch room into which fresh air is automatically blown immediately the main extraction is put on, *i.e.* a small fan is started when equipment in that building is energised. In this way the equipment in the switch room

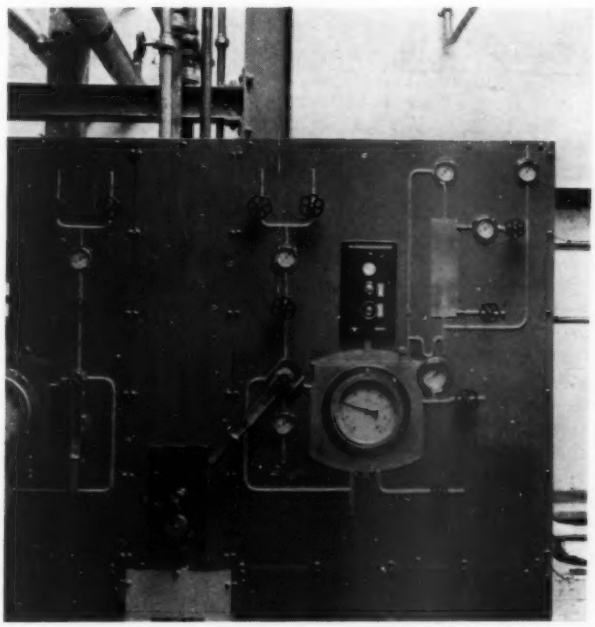


Fig. 3. Diagrammatic panel erected for development unit manufacturing small quantities of chemicals for evaluation.

is kept in good condition and, as inflammable vapours are excluded by the positive internal pressure, non-flameproof equipment can be installed. Maintenance on electrical gear which might otherwise have involved the opening of switchgear in a flameproof area is made simpler.

Diagrammatic panels

The conclusion has been reached that diagrammatic panels more than justify the extra expense, particularly as for this type of work they can readily be made up on site by the works maintenance men. Fig. 3 shows an example which was erected for the Development Unit, a unit which is used to manufacture small quantities of chemicals for clinical or market evaluation and for developing chemical processes. There are several advantages. A development unit unfortunately always tends to be in a mess with a jumble of drums and carboys and buckets and scoops and scales. By starting with a decent-looking unit a man's work gets off on the right foot and the problem of keeping up good housekeeping is eased. Good housekeeping keeps down accidents and improves efficiency.

Secondly, the panel groups the instruments and helps to give the maximum of information in the course of each operation. And thirdly it makes switches of labour easier. A man who perhaps has not operated a particular vessel for some time is immediately reminded of the controls and their functions. He can act rapidly and decisively in the event of any emergency. Time is saved and efficiency is gained.

Portable instruments

As a final point, portable instruments are well worth serious consideration. One which comes in for the most use is the portable temperature recorder, operated by clockwork and therefore suitable for hazardous areas. For experimental work, or for a process where trouble is being encountered, as seems to happen occasionally to even the most docile and established of processes, it is invaluable. The bulb is slipped into the thermometer pocket or connection occupied by the normal indicating instrument, and the record is provided continuously without further attention, being available for later study at leisure. Further examples are in the study of fractional crystallisations or other cooling processes which extend over long periods, very often through the night, and which might, therefore, only be investigated by the expenditure of a very great deal of effort.

The examples quoted are very typical of many which are encountered in the operation of any small chemical works. No special effort has been made to venture into unusual instrumentation, and the installation of the controls indicated has resulted from the logical consideration of the simplest manner of tackling problems as they arose. No use has yet been made of the more complicated type of flow controller or programme controller, but there seems no obstacle to their use if the occasion should arise.

In summary, it is evident that the two functions of instruments of providing information and providing control are just as important relatively in a small works as in a large one. The relative value of their use is quite independent of the size of the factory. An extensive plant will benefit from extensive instrumentation, while a simple plant can very often equally profit from the application of instruments in proportion to its size. In essence the difference is the type of organisations required to install and maintain. Where a factory is not large enough to be self-supporting for these functions, then difficulties can usually be overcome by use of the advice and maintenance facilities provided by the instrument manufacturers.

Some of the examples listed have been given a precise financial value, and others have been put forward with only a statement of opinion. But experience has shown that simple instrumentation is justified in the smallest of fine chemical factories to provide consistent quality, reduction in costs, and to reduce the call on an already extended labour market. Any method of working which reduces the number of skilled operatives required has merit for this reason alone, as obtaining sufficient labour of the right type becomes increasingly difficult.

The Sudan's Needs for Crop Protection Chemicals

Chemicals are playing an important part in the economy of the Sudan where weed control has been a long-standing problem, especially in the cotton growing areas. Most of the other crops such as beans and groundnuts are not sufficiently developed with the exception of durra (millet), which is being cultivated on a larger scale, and this year's crop reached a new record level.

*Iso*propyl *m* - chlorophenylcarbamate, monuron (N′-*p*-chlorophenyl-NN - dimethylurea), N′ - 3 : 4 - dichlorophenyl - NN - dimethylurea and NN-dimethylphenylurea may be used as pre-emergence applications for weed control in cotton. In the Gezira irrigated area there are some factors which would preclude the use of pre-emergence weedkillers but on the more southerly pump schemes, which are usually sown with the rains, and in the Gash Delta, one of the above chemicals may find a place. Monuron and NN-dimethylphenylurea are understood to be the more promising.

The early eradication of weeds in fallows has been instrumental in increasing significantly cotton yields in the following year. Of the various hormone-type weedkillers which have been tried for killing the weeds on fallows preceding cotton, mixtures of the sodium salts of 2,4-D and 2,4,5-T are said to be showing the most promise. There is a danger to newly emerged cotton with the use of hormones for the control of weeds in adjacent fallows. In view of this, the Sudan Gezira Board have switched their attention to the use of low dosage rates of the substituted ureas monuron and NN-dimethylphenylurea for the control of fallow weeds. Mechanical eradication is proving more efficient than chemical control in the case of seed grass.

When cotton is grown on the Rainlands on an extensive scale and in fairly large units as is envisaged in the near future, picking will have to be mechanised which will involve the use of a chemical defoliant such as sodium chlorate.

The sodium salt of 2,4-D is stated to be effective in the control of the weed, buda, which is seriously retarding the yields of durra (millet). It is, however, a costly operation and this, combined with lack of technical knowledge, is delaying the widespread adoption of spraying against this pest.

With the expansion of mechanised crop cultivation in the Rainlands, it is expected that weedkillers will play a prominent part in this

(Continued on page 27)

Flow Measurement in the Chemical Industry

The new Foxboro magnetic flow meter.

A review of developments and trends in instrumentation was published in the May issue of "Manufacturing Chemist," and the November issue contained an account of instruments for temperature measurement. This article deals with instruments for measuring flow —a process variable of great operational and economic importance. Like the last article, the subject is dealt with in a general, non-mathematical manner, and is intended to be of use to those who wish to acquire a basic knowledge, as well as to those who desire to study the subject more closely, in which case the article will prove a convenient introduction to the standard text-books.

THE requirements of the modern chemical and allied industries have made immense demands upon the inventiveness, ingenuity and manufacturing skill of the makers of instruments that measure the flow of fluids. The completeness of the range of instruments now available is shown by the fact that there is scarcely a known fluid which cannot be measured with a satisfactory degree of accuracy and convenience —whether it be a heavy or viscous liquid, slurry or light gas, at a high or low temperature or pressure, inert or corrosive in nature, and at a rate of flow which may vary from a mere trickle to many gallons per minute. Traditional methods have been extended and new means evolved so that an indication of the flow at any given moment can be shown by means of a pointer on a calibrated scale, a continuous and permanent record obtained of the flow over a period on a chart, the total flow summated or totalised by an integrator, the flow at frequent intervals printed on a paper tape or sheet by means of an automatic typewriter, and visual and/or audible alarms or shut-down mechanisms actuated in case of abnormal flow rates. In all cases the reading instrument may be many yards or miles away from the duct or pipeline through which the fluid flows; all in addition, of course, to the maintenance of the rate of flow within close limits by means of an automatic controller, the function of which is, however, outside the scope of this article.

Reasons for installation

The reasons for installing a flowmeter should be considered carefully, for such an instrument is not cheap and the total outlay must be justified. It may be installed to produce a greater convenience and efficiency in production, greater overall economy and to provide a greater safety factor for plant and personnel. Many instruments effect economy by measuring accurately the supplies of fuel or services to plant—such as oil, steam, hot water or gas for heating, or cold water for cooling. Modern production methods hold that the quantities of such services used by each section of plant or department should be known, and they should not be used *ad lib.* because they are —in effect—"on tap." Only upon such a basis can efficient cost accounting be based.

Flow meters that show the total throughput may yield a considerable amount of information in addition to the daily or weekly figures; they may provide an indication of the state of efficiency of such items of plant as pumps, heat exchangers, filters and so on; and thus may give an idea of their condition, as to whether they need to be reconditioned, repaired or replaced.

On the plant, flow meters may be used for a great number of purposes. They may be employed to admit a fluid to a reaction vessel at a correct rate; to enable two fluids to be mixed in definite proportions and so to avoid excess of either in the final mixture; to obtain the correct rate of flow of fuel to a furnace and to permit the correct ratio of fuel and air for complete combustion; or to obtain reliable statistics on fluid ingredients and raw materials for costing purposes; to ensure that the correct rates of flow are not exceeded; and for many other purposes.

Before studying any particular flow meter in detail, it is necessary to review briefly the functions of instruments for the measurement of flow under different conditions. Firstly, only passing reference need be made to instruments to measure the flow of liquids in open channels, employing such devices as weirs, flumes and V-notches—as the fluids

employed in the chemical industry—unlike those encountered, for instance, in water or sewage engineering—practically always flow in closed pipes or ducts. Secondly, little need be said of total quantity meters, the function of which—as the name implies—is to measure the total quantity passing along a pipe, no account being taken of its rate of flow. Such instruments are used for the measurement of the total flow of very large quantities of fluids such as water, oil, petrol or town's gas; this may be one of a number of types; indeed, the very diversity of such instruments precludes a description here, and, in any case, instruments that indicate and/or record are often equipped with an integrator which itself serves the same purpose as a separate total quantity measuring instrument.

Differential pressure flow meters

These are probably the most widely used flow measuring instruments in the chemical industry. Their underlying principle can be readily understood. When a fluid is passing through a pipe it is exerting a pressure in all directions. If a constriction is placed in the pipe, the fluid flows through this section more rapidly than when flowing through the rest of the pipe in order that the same quantity may pass through. At the constriction the kinetic energy of the fluid is greater and its potential energy is less so that its static pressure is less. If the pressure of the fluid at suitable points on either side of the restriction, upstream and downstream, is measured, it is found that the difference between those pressures that is, the differential pressure—varies according to a definite relationship, which is the square of the rate of flow. That relationship provides a basis on which measurements can be made, and is used by all instruments of the differential pressure type. Such instruments therefore consist of two distinct elements—the primary element to produce the differential pressure, and the secondary element to interpret that pressure in suitable units of rate of flow, such as gallons per hour or cubic feet per minute.

If tappings from the point on each side of the constriction are taken to a mercury U-tube, a depression of the mercury will be seen in the limb that is connected with the upstream point, indicating a higher pressure, and a corresponding rise in the level of the mercury will take place in the limb connected to the downstream side, indicating the lower pressure. The difference in level of the mercury obviously will be a direct measure of the differential pressure, and hence of the rate of flow.

PRESSURE DIFFERENTIAL DEVICES

Orifice plate

The simplest and probably the most commonly used differential pressure device is the orifice plate—a flat disc of steel, stainless steel, phosphor bronze or Monel, usually $\frac{1}{16}$ in. to $\frac{1}{4}$in. thick, with an orifice—usually circular, through which the fluid flows. The plate is usually fitted between adjacent flanges of the pipe, so that the orifice is concentric with the bore. When dirty fluids or fluids containing solids in suspension are to be measured, a plate of the eccentric or segmental type is used, the orifice being located with the lower edge coincident with the inside of the bottom of the pipe, so that solids are not obstructed in their passage. To ensure accurate measurement, it is important for the edge of the orifice to be perfectly square and sharp; wear and abrasion greatly affect the accuracy, so that under some conditions the plate may have to be replaced frequently. An orifice plate may sometimes be made with an additional small hole. When a gas is being measured the plate will be fitted so that this hole is below the orifice to allow condensate to pass, and when the fluid is a liquid the plate will be fitted with the hole above the orifice so that gases can pass and not build up in pockets.

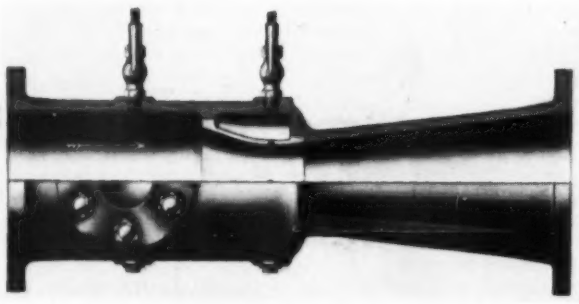
The advantage of the orifice plate is that it can be used for the measurement of almost all gases and liquids; it can be made in a large variety of sizes and to cover a wide range of flow rates; it is dependable in performance, simple and inexpensive to manufacture, easy to duplicate precisely, compact and portable, and easy to install or to change. It is most suitable for clean gases, non-viscous liquids and for moderate rates of flow. The great disadvantage of an orifice plate is that it produces a considerable permanent loss of head—that is, resistance to the flow; consequently, pumping costs to overcome the resistance may be considerable over a period in the case of large flows.

Venturi tube

It is for that reason that another type of pressure differential device having a lower permanent loss may be used, and a very common type is the Venturi tube. This consists of an entrance cone, or flare, and a downstream or discharge cone, joined together by a short length of parallel pipe called the throat section. The purpose of the shaped entrance is to provide a smooth approach to the throat section; and the purpose of the downstream cone is to reduce the loss of head by reducing turbulence. Thus the Venturi tube is streamlined throughout, and it owes its efficiency to that attribute. The Venturi tube can be made of a variety of materials to suit the application—in cast iron for use with cold water, in stainless steel, rustless iron and other resistant materials for corrosive fluids. For higher pressures—such as boiler feed—it may be of cast or fabricated steel. It can be made in a wide range of sizes—with a throat diameter as small as $\frac{1}{2}$ in. to as large as 9 ft. or more—the only limits being those of manufacture.

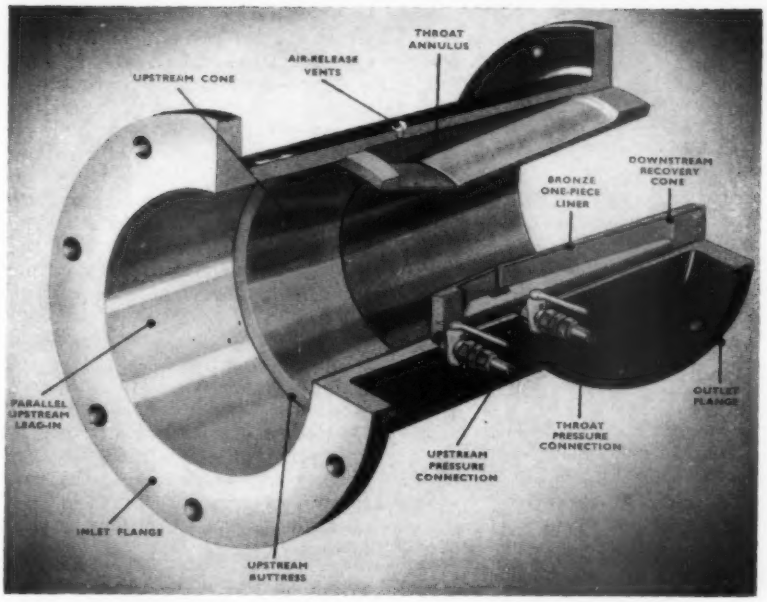
Dall tube

Comparatively recently, another type of differential pressure device has been evolved—the Dall tube—which has a permanent pressure loss



Venturi flow tube (short-pattern).

(This and the following photographs appear by courtesy of George Kent Ltd).



Cut-away illustration of a Dall tube, showing principal parts.

of even less than that of the Venturi tube, of only about 5%. The Dall tube has two truncated cones each with a relatively abrupt decrease in diameter, the throat being formed by a circumferential slot between the two smaller diameters of the cones. The Dall tube is used for comparatively low rates of flow, when the velocity would be too low to provide a sufficiently large pressure differential to operate some types of reading instrument, such as recorders.

Flow nozzle

A type of differential pressure device which is not widely used in Great Britain is the flow nozzle. In effect it is a very short Venturi tube without the discharge cone. It is usually made of gunmetal, stainless steel or Monel metal, and only practical manufacturing considerations limit the size. Like the orifice plate, it can usually be inserted between adjacent flanges in the pipeline. It is much less expensive than a Venturi tube, and is obviously easier to install. It permits measurement of rates of flow which are much higher than the maximum rates of flow for which an orifice plate can be used. Hence it is especially useful when large flows under high pressures and flowing through minimum size pipelines are to be measured. It can be used therefore for measuring the flow of high pressure gas, for steam which has been let down and is discharging into the atmosphere, and for liquids that are discharging into the atmosphere.

Pitot tube

Another type of differential pressure device that is sometimes used is the pitot tube. This is a narrow tube supported in the pipe or duct, with the head bent so that the open end—or impact opening, as it is called—faces directly the oncoming fluid. The pitot tube converts the velocity of the fluid which impinges against the open end into a head, or pressure; as this pressure bears a square law relationship to the rate of flow, it can be applied—together with the static pressure from a tapping on the side of the pipe—to a suitable differential pressure measuring instrument, and the rate of flow interpreted in appropriate units. A combined pitot tube—known as a pitot static tube—is often used, and consists of two concentric tubes, the impact tube surrounded by the static tube, which has openings in its circumference which are at right angles to the direction of flow. The tubes are connected to the differential pressure measuring instrument. The position in which a pitot tube is permanently installed within the pipe is determined as a result of a number of exploratory tests in different positions. The advantage of a pitot tube is that it is relatively inexpensive and can be easily installed. The pressure loss is, of course, very small. The great disadvantage is that it cannot be used for fluids containing small solid particles as the pipe openings easily clog up and it cannot be used for fluids at low velocities.

A description of pressure differential devices would not be complete without reference to some of the problems in piping arrangements associated with their installation. It will be realised that the correct measurement from the use of a pressure differential device in most cases depends upon a uniform and undistorted flow of fluid through the pipe. Consequently the device must be installed so that there is a considerable length of straight pipe on the upstream side, and for a distance equivalent to a few pipe diameters on the downstream side as well. Also, for a considerable distance on the upstream side there should be no valve, which, when partly open, can give rise to a powerful jet effect; and there should be no lateral entry into the pipe upstream, especially if it is tangential, which would cause a swirl; and an expanding cone would produce uneven flow distribution. When disturbed flow is encountered, it may in many cases be corrected by a device such as a nest of pipes, straightening vanes or grid plates.

The installation of instruments may give rise to various difficulties. Whereas the simplest method of transmitting the pressures from the upstream and downstream sides of the differential pressure device is by small-bore tubes, filled with the fluid from the pipe, under some circumstances this is not possible. Such cases arise when the fluid is corrosive and will damage the tapping tubes or the instrument; or when the fluid is inflammable, poisonous or otherwise dangerous; or when the fluid in the pipe is at a relatively high temperature and may become viscous or even freeze when allowed to cool to atmospheric temperature; or when the fluid contains suspended solids, which may clog the tapping tubes; or when the instrument is mounted at a distance from the measuring point or is above the level of the pipe so that when a liquid is being measured air or gas locks may form in the tapping tubes. Most of these conditions may be obviated by the use of a sealing liquid—that is, a liquid to fill the tubes between

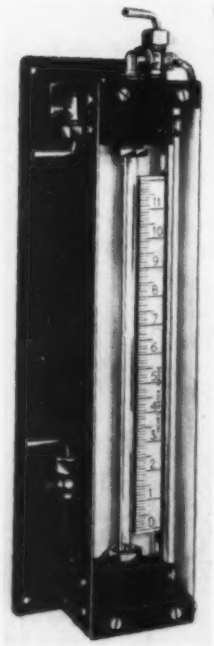
the tapping points and the instrument, which is not miscible with or attacked by the fluid in the pipeline, and which, in turn, will not damage or corrode the instrument. Other conditions may usually be overcome by purging systems or other means.

Reading instruments

A reading instrument measures the differential pressure produced by an orifice plate, Venturi tube or other device, and interprets it in units of flow, such as gallons per hour or cubic feet per minute. The type of instrument to be employed depends on a number of factors, such as whether purely local indication and/or recording and integration are required, or whether the indicator or recorder is to be installed at a distance from the point of measurement, such as on a panel on which a number of instruments are grouped, or in a centralised instrument or control room. Such a requirement will necessitate some form of transmission, such as by pneumatic or electrical means.

Mercury manometer type

For purely local measurement a reading instrument of the mercury manometer type is often commonly used. In this instrument the limb of the U-tube connected to the upstream side of the differential pressure device is made considerably wider; inside a metal float is arranged to rest on the surface of the mercury, and is connected—through a pressure-tight gland—by means of linkage to a pointer traversing a scale, which is calibrated in suitable units of flow. In the case of a recorder the float is connected similarly to a pen, which is caused to trace a line on a slowly moving chart, the mechanism of which is driven by a clockwork or electric motor. The chart usually covers a period of operation of 12-hr., 24-hr. or 7 days, or it may be of the "strip" type and cover a period of up to 50 days. The differential pressure produced by the flow is in proportion to the square of the rate of flow. Consequently the reading instrument will normally have a scale on which the readings are comparatively cramped at the lower end, and widely spaced at the upper end. As such a scale is not easy to read, several methods of square root extraction have been developed so that the scale is approximately evenly divided throughout. One of these is the Le Doux bell meter, in which square root compensation is achieved by the use of a manometer containing a hollow float, the inside of which is of parabolic form. Pressure from the upstream side of the differential pressure device is applied to the inside of the bell, and from the downstream side to the chamber in which the bell floats in mercury. Owing to the shape of the bell, the rise of the bell transmits through linkage to the external pointer a movement which is linear.



ST/L manometer (liquid-oil, water or mercury).

Bellows type

The mercury manometer is satisfactory for all normal uses, but one of its disadvantages is that in some circumstances it does not afford sufficient protection against overload. Under such conditions, if there is a large and sudden surge of pressure in the pipeline on the upstream side of the differential pressure device, mercury from the downstream leg may actually be forced up the whole length of the tapping tube and escape into the flowline, with inevitable contamination of the fluid and possible extensive damage to plant. A type of instrument that overcomes this drawback is the bellows type. This instrument contains, inside a pressure-tight chamber, a bellows which divides the chamber into two compartments. The lower pressure is applied to the compartment inside the bellows, and the higher pressure to the compartment outside the bellows; therefore an increase in flow producing an increase in differential pressure forces the bellows to contract. The movement of the free end of the bellows is transmitted to a torque tube by means of a flexible strip, which is used instead of the conventional pressure-tight gland assembly to transfer the movement of the bellows outside the unit to a pointer traversing a scale. The unit is fitted with stops so that however great the differential pressure the bellows cannot extend or contract beyond a certain extent, so no damage is caused either to the instrument or to the plant.

Pneumatic flow transmitter

When the indication is required at a relatively short distance from the point of measurement, a pneumatic flow transmitter may be used. This, in brief—compares the pressures fed from either side of the differential pressure device and produces an output air pressure the value of which depends on that differential pressure. This output air pressure is conveyed along small-bore tubing to the indicating instrument, which is in reality a pressure gauge but with the scale calibrated in units of flow.

Some flow transmitters operate on the "force-balance" principle, in which the differential pressure is applied to a diaphragm within a chamber and connected to a weighbeam, on the other side of which is fitted a reaction diaphragm. Any change in the rate of flow, producing a change in the differential pressure, tends to move the weighbeam, and this action varies the bleed of air from a nozzle and alters the air pressure behind the nozzle. This is applied to the reaction diaphragm and restores the balance. It is this "back-pressure" that is led off through the tube to the reading instrument, which may be of the indicating or recording type.

The force balance pneumatic transmitter, by reason of its construction, possesses several additional advantages. As the chambers on either side of the diaphragm to which the fluid from the tapping tubes is admitted as well as the diaphragm itself can be made of a

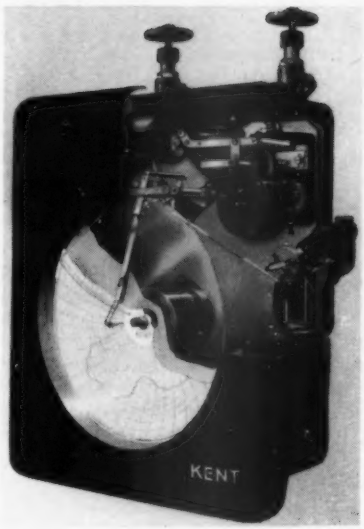
variety of resistant materials, corrosive fluids can be measured; as practically no movement is entailed either of the fluid in the tubes or of any part of the instrument itself, there is practically no lag in the measurement of highly viscous fluids, such as fuel oil or glycerin; and as the fluid is contained in a completely sealed system, a pneumatic transmitter can be used for the measurement of flow of inflammable, explosive, toxic or otherwise dangerous fluids without hazards of leakage; also it can be used in cases when the fluid to be measured would either congeal or vaporise in tapping tubes exposed to atmospheric temperature, as the instrument may be saddle-mounted directly on the flowline, with short connecting tubes and the diaphragm casing " lagged " to keep the fluid in the chambers at pipeline temperature.

The pneumatic transmitter is used for measuring the flows of such widely-differing fluids as industrial fuel oil, liquid ammonia, sulphuric acid, and—in instruments in which the diaphragm is replaced by a piston—heavy pitch or residual oils.

By reason of its ability to measure the rates of flow of so many " difficult " fluids, the pneumatic transmitter is sometimes used purely as a local measuring instrument. The same output air pressure that operates the local indicator can, of course, be used to actuate in addition an air-operated automatic flow controller, as well as a remote reading instrument at the far end of the small-bore tube.

Electrical flow transmitters

If the reading instrument is to be at a considerable distance, electrical transmission is used. Instruments for this purpose may be of one of many types. In one commonly-used type the rise and fall of the mercury in the U-tube, according to the differential pressure determined by the rate of flow, is caused to alter the conductivity and hence the current in a circuit in which the reading instrument is included. The conductivity is altered by arranging a number of rods of different lengths to dip into the mercury of the downstream limb, so that when the mercury rises and falls a varying number of resistances are included in the circuit and the resistance and hence the conductivity of the circuit is altered.



Cut-away view of a Commander flow recorder with integrator.

Integrators

Integrators that totalise the flow are of a wide variety of types, operate on completely different principles, and are somewhat intricate in construction so that a description is impossible here. Some types on an instrument for local measurement employ cam mechanisms which control the speed of a counter; some instruments for remote installation measure the power consumption of the circuit, since this is a function of the rate of flow. The power consumption is measured by an instrument that resembles a conventional watt-hour meter, but which is modified so that it is unaffected by normal variations in voltage and frequency.

Ring balance meter

For the measurement of low pressure gases—or, on the other hand, fluids at a very high static pressure—a ring balance meter is frequently used. This consists of a hollow ring, pivoted at the centre on knife edges. The upper part is divided by a partition, and the lower part contains a liquid, such as oil, the function of which is to form a seal between the two compartments. The ring balance meter is used in conjunction with a differential pressure device, and the pressures on either side of the device are conveyed to the space on each side of the partition by flexible tubes, so that the movement of the ring is not impeded. A counterbalance weight is fitted to the ring so that it is at its lowest point when the pressures on either side of the partition are equal. As the rate of flow changes, the change in the differential between the pressures exerted on either side of the partition causes the ring to tilt, until it is balanced by the weight. In tilting, the ring positions, by means of a cam system, a pointer moving over a suitably calibrated scale. The cam is so shaped that it imparts increased movement to the pointer near zero and a lesser movement near maximum, so that the result is a pointer movement that is practically linearly proportional to the rate of flow. As this type of flow meter does not require a pressure-tight gland, such instruments are sometimes used for the measurement of rates of flow of gases at a high static pressure. Also, sometimes ring-balance meters are used for the measurement of the rate of flow of liquids, mercury being used as the sealing liquid in the ring.

Bell-type meter

Another type of instrument fulfilling a similar function to the ring-balance is the bell-type. The pressure chamber contains a bell with the open end downwards. Liquid in the bottom of the chamber forms a seal between the space inside the bell and the outside. The pressure from the upstream tapping is conveyed to the space outside the bell and the downstream pressure to the space inside the bell. When the flow of fluid increases, the differential pressure raises the bell a proportionate amount and the movement is transmitted to the outside of the instrument through a spindle rotating in a pressure-tight bearing or a segmented lever and chain assembly. The indicating pointer or recording pen is attached to the segmented lever so that it traverses the calibrated scale.

VARIABLE AREA FLOW METERS

A type of flow meter that has found ever-widening application during recent years operates on the variable area principle. The basic construction is simple—consisting essentially of a tapered glass or metal tube, mounted vertically, with the wide end at the top, in which a float is free to move up and down. When a fluid flows up the tube, it carries with it the float, as the upward force exerted by the fluid is greater than the immersed weight

of the float. As the float rises, the annular area between it and the tube wall gradually increases—due to the taper of the tube—so that the upward force due to the fluid velocity decreases. At a certain point all the forces acting on the float are in equilibrium, when the force due to the fluid velocity is exactly balanced by the weight of the float (less the weight of the fluid it displaces). By noting the reading of the scale, the rate of flow can be determined. To obtain uniform hydro-dynamic conditions at all flow rates, the float on some models is arranged to occupy always a central position within the tube by means of guides or a rod or pole, on which the float is a sliding fit.

Though the variable area flow meter is primarily an indicating device, it can be arranged to actuate a recorder and/or an integrator by several methods, by transferring the movement of the float to the outside of the tube. This may be either by a magnetic coupling or for electrical transmission by induction.

Advantages

The variable area flow meter has a number of advantages, one of the most important of which is that the permanent pressure loss is relatively small. Also it can be used for practically all kinds of fluids, from heavy viscous or opaque liquids to light gases, and over a very wide range of flow rates, and at high or low temperatures and pressures. It is relatively simple in construction, inexpensive in cost, and there is no mechanism to develop faults. It has a straight line scale from 10% to 100% of its range. Installation is simplified in that the device does not necessitate straight lengths of pipe in the flowline. Special types are made for the measurement of fluids at high temperatures or of a dangerous nature, when the actual measuring tube is enclosed in an armoured case with heavy glass windows. Other types with heating coils within the case have been developed for measuring the flow of condensible vapours or liquids that are liable to freeze or which must be kept hot. Variable area flow meters are especially useful for measuring very small rates of flow, as they can measure a rate as low as that corresponding to a few drops per second of a liquid. In smaller sizes they are considerably less expensive than other types of flow meters.

RECENTLY-DEVELOPED FLOW METERS

Electro-magnetic

A recently developed flow meter is the electro-magnetic type. Its full range of possibilities remains to be explored. The principle of operation depends upon magnetic induction. The device has a permanent or electro-magnet so arranged that the magnetic flux traverses the pipe at right angles to the direction of flow. The section of pipe at the point of measurement must be of a non-magnetic, non-conducting material. The liquid passing through the pipeline may be considered as an electrical conductor moving in the direction of flow, which in passing through the magnetic field induces an e.m.f. within the liquid. Two electrodes are embedded in the wall of the pipe in contact with the liquid, the faces being flush with the inner surface of the pipe in order to cause no disturbance. The magnitude of the e.m.f. is proportional to the velocity of flow. The e.m.f. generated is amplified electronically and interpreted in rates of flow by one of the usual forms of electrical measuring instrument. An advantage of this type of instrument is that its accuracy is not affected by the viscosity of the liquid. Also, it is claimed that the accuracy is not affected by the density of the liquid and suspended solids. In addition, it is possible to measure rates of flow over a wide range, as the square root characteristic does not apply. Its disadvantages are that it cannot be used for gases, or for certain chemicals and hydrocarbons such as petroleum products. As the electromagnetic flow meter is of very recent introduction, and there are comparatively few in operation in Britain, few details of its performance are available.

Ultrasonic

A more recent innovation is the ultrasonic flow meter, of which, as yet only very few—if any—are in use in Britain for industrial purposes. The instrument employs two beams of energy at an ultrasonic frequency, in the neighbourhood of 10 megacycles per second. One is transmitted diagonally upstream and the other diagonally downstream in pulses at intervals.

The difference in transit times upstream and downstream gives rise to a resonant frequency, which depends on the velocity of flow of the liquid, and so of which it is a measure.

By the use of instruments of the more traditional types incorporating refinements and new developments which greatly extend their sphere of usefulness and result in a higher degree of accuracy and greater convenience in operation, together with new types—which while as yet not fully exploited, show great possibilities—it is safe to say that the chemical and allied industries are amply furnished with flow measuring instruments.

ANTIBIOTIC FROM MAGGOTS

Recent work at St. Mary's Hospital Medical School, London, has revealed an antibiotic in the excretions of the black blow-fly maggots which may be responsible for their anti-bacterial properties. On dilution with fluid culture media this material was found to be effective against certain streptococci and pneumococci.

The exact source of the antibiotic is not known, but it is thought by the authors, E. R. Pavillard and E. A. Wright, to be a product of the larvæ themselves and not of the micro-organisms associated with them.—*Nature*, 1957, **180**, (4592), p. 916.

SEASONAL GREETINGS

We thank our many friends for their kind Seasonal Greetings sent in the form of Christmas cards, calendars, diaries, etc., and in particular:

Monsanto Chemicals Ltd., Brook Motors and Control Gear, Sharples, Coty (England) Ltd., Imperial Chemical Industries Ltd., Howards of Ilford, Chemicals and Feeds Ltd., Glass Manufacturers' Federation, Leon G. Davis, The Wellcome Foundation Ltd., Fertilizers and Chemicals Ltd., Haifa, Drs. D. W. Kent-Jones and A. J. Amos, Industrial and Commercial Finance Corporation, F. and D. Brownlie, M. G. de Silva, Lever Bros. (Cey.) Ltd., Colombo, Roche Products Ltd., Lederle Laboratories, Prof. Hugh Nicol, Elga Products Ltd., Dr. Wm. Mitchell, The Winter Thomas Co. Ltd., Galloway and Barton-Wright, John Gosheron and Co. Ltd., The National Pharmaceutical Union, J. A. Radley, Elizabeth Anderson, The Chemists' Federation, Smith Kline and French Laboratories Ltd., Ortho Pharmaceuticals Ltd., Minnesota Mining and Manufacturing Co. Ltd., Young and Rubicam, Sidney-Barton, John Gosheron and Co. Ltd., British Cellophane Ltd., Globe News Service, A. Krajkeman, Aero Research Ltd., Dutton and Reinisch Ltd., Air Control Installations Ltd., Midland Silicones Ltd., Max Factor Ltd., Arthol Ltd., Armstrong Cork Co., T. and H. Smith, Popper and Co., Cambridge Instrument Co.

New Instruments and Apparatus

Analyser ★ Counter-current extractor ★ Gas-liquid chromatographs ★ Electronic recorder /controllers ★ Temperature controller ★ Process control ★ pH meters ★ Vacuum moisture tester ★ Operations recorder ★ Spectrophotometry accessories ★ Electrolytic hygrometer ★ Potentiometric titrator ★ Ultrasonic cleaning ★ Sulphur content apparatus

Automatic analysis

The B.T.L. *Analmatic*—analyser, grouped individual samples, is designed to enable large numbers of colorimetric assays to be carried out quickly and accurately by semi-skilled labour. It is of particular use where the individual identity of the sample must be maintained. The equipment is semi-automatic, the addition of reagents and the measurements being fully automatic, while the movement of samples and the initiation of each operation is manual.

The equipment is flexible, and can be readily adapted to the performance of any required assay of this type. The work is carried out in test-tubes, which are handled in racks each holding 30 tubes. It is not necessary for the tubes to be removed from the racks during the operation.

Three basic units are available:

(1) *Reagent pipettes.* These consist of three automatic pipettes, mounted above special guides.

The tube-racks are pushed in steps through the guides, and as each set of three tubes comes into position under the burette jets a preset volume of reagent is added with high accuracy. The addition is fully automatic, and is initiated by the operator moving the rack one step. A pilot lamp indicates when the rack can be moved. After completing a rack of tubes, the rack is withdrawn and carried by the operator to the next stage. At present the pipettes are available with maximum volumes of 1, 2, 5, 10 and 20 ml., and may each be adjusted to any desired volume in their range.

A complete rack can be treated in about 90 sec.

(2) *Transfer pipettes.* These are used in cases where, for example, a light solvent liquid-liquid extraction is required, and a set volume of extract must be transferred to a second tube.

Two racks, one containing the sample tubes and the other having empty tubes, are moved side by side through guides in steps as in the reagent pipettes. As each set of tubes comes into place, three piston type pipettes dip into the solvent layer in the first tubes, fill to volume, lift, and move across into the empty tubes. The pipettes then discharge their contents, and move out of the way so that the operator can move the racks a further step. A pilot lamp indicates when the racks can be moved.

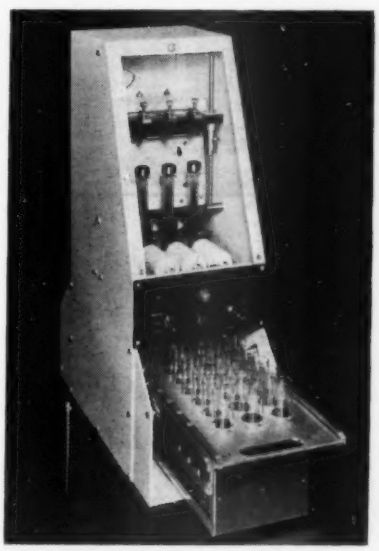
The sequence at each step is controlled electrically, but the operations are done pneumatically.

At present the transfer is limited to 2 ml., but equipment for other volumes can be designed. A complete rack of 30 tubes transferring to a second rack can be handled in about 3 min.

(3) *Recording absortiometer.* This new design of absorptiometer is intended to operate in conjunction with the equipment described above. The viewing head is dipped into the sample liquor for measurement, which remains in the tube in the rack. There is no need to transfer the liquid to a special cuvette. The instrument is of the double beam type, and the result is recorded on a printing type recorder as optical transmission or density. The operating speed is high, a rack of 30 tubes being dealt with in about 5 min.

Countercurrent extraction apparatus

Countercurrent multiple extraction can be used for the purification of any substance which will partition between two liquid phases, and has been used for the separation of alkaloids, amino-acids, amines, antibiotics, fatty acids, peptides, phenols, phosphatides, steroids, sugars, vitamins, etc.



The B.T.L. Analmatic analyser for rapid colorimetric assay of large number of samples.

J. W. Towers and Co. Ltd. have introduced three new models to their range of countercurrent apparatus.

The fully automatic, 240 tube countercurrent apparatus follows the general construction of the smaller fully automatic apparatus. It consists of a robot drive unit and a single stand unit 6 ft. 6 in. long, holding 240 all-glass countercurrent tubes, 10, 20 or 40 ml. lower phase liquid and 40 ml. max. upper phase. The tubes are mounted in four tiers to save space, but are connected so that the whole number of tubes can be used in one test and, if required, the upper phase liquid may be re-cycled. According to the manufacturers the apparatus has a larger number of tubes than any standard instrument previously manufactured in this country, and is more compact than any other type.

The Towers micro scale automatic countercurrent apparatus is for separations involving small quantities of materials from as little as 1 mg. upwards. The glass tubes are of small dimensions with lower and upper phase volumes of 2 ml., and are designed to ensure efficient mixing, settling and negligible hold-up after transfer. The tubes are constructed in units of a convenient size for handling and these units together with an automatic top phase dispenser are mounted in a supporting frame the axle of which connects to a robot-drive mechanism. Frames are readily made up to carry as many micro countercurrent tubes as required. A 96-tube apparatus is a convenient size for many purposes and this takes up a space of approximately 3 ft. × 2 ft. excluding the robot.

The Towers small-scale hand-operated countercurrent apparatus is for teaching and research purposes. The apparatus consists of 20 countercurrent tubes of the Craig pattern, each of 20 ml. lower and 20 ml. upper phase, mounted on a stove enamelled stand together with automatic top phase dispenser.

Gas-liquid partition chromatography

Gas-liquid partition chromatography provides for both separation and identification in a single method of analysis. It is much more rapid and efficient than conventional fractional distillation requiring, in comparison,

only milligrammes of sample. Its range of application is wide. Organic compounds in the boiling range 0-300°C. and of varying complexity, from C_1-C_{22}, have been analysed both qualitatively and quantitatively.

In the Griffin and George gas-liquid chromatography apparatus the basic principle is the same; the materials are partitioned between two phases, one stationary, the other mobile. In G.L.P.C. the mobile phase is a gas and the stationary phase is an inert supporting material impregnated with a non-volatile solvent such as dinonyl phthalate, silicone fluid and others.

The liquid sample is introduced by means of a hypodermic syringe through a rubber serum cap into the carrier gas which passes down the column. The column contains the stationary liquid phase held on a solid, inert, supporting material, usually Kieselguhr, a diatomaceous earth. The components of the sample injected have different retention times for a particular liquid phase and this results in the resolution of the mixture into single specific components.

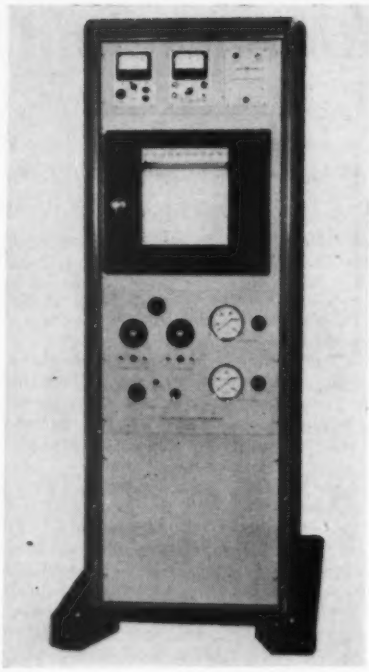
They are detected at the exit end of the column by measurement of the change in thermal conductivity of the gas, caused by the presence of a vapour (in this case a component of the sample) foreign to the reference inlet gas stream. This operation is automatically recorded and the succession of the different components as they leave the column is drawn as a series of peaks. On this trace, the position of the peak affords the qualitative evidence for analysis and the height, or area, of the peak, the quantitative information required.

G.L.P.C. is very efficient for the qualitative and quantitative analysis of gases, liquids and some solids in the boiling range 0-350°C., It is possible, for instance, to make a chromatogram of an essential oil showing all the components present. This can be used to compare different samples and to state exactly the differences between them.

G.L.P.C. can be used as a preparative tool in conjunction with the infra-red and mass spectrometer methods of analysis. In research work G.L.P.C. can be used to follow the course of chemical reactions by the analysis of the intermediate products formed. The analysis of distillation fractions, azeotropes, etc., can be carried out with speed and accuracy using G.L.P.C. equipment.

Finally, trace analysis and subsequent purity checks, as a routine method, are greatly facilitated by G.L.P.C.

The internal standard technique of quantitative analysis consists of adding to a known amount of sample a known volume of reference standard material. From experimental runs using blends of known composition, calibration curves can be drawn, plotting percentage of component against the peak height ratio of component to internal reference material. Peak height ratios are almost a linear function of concentration when symmetrical Gaussian type peaks are obtained. More accurately, peak areas can be used. Using hydrogen or helium as carrier gas, a quantitative estimation is carried out by summation of the areas beneath the peaks and equating to 100% composition; the fraction of the total area, due to a specific component, can then be calculated.



Pye gas-liquid chromatography equipment.

A complete gas - liquid chromatography instrument and component parts are now on the market giving an overall sensitivity which, according to the makers, W. G. Pye and Co. Ltd., is considerably higher than is normally achieved by using a katharometer as a detector. The detector output is amplified considerably by a circuit which is at the same time insensitive to noise, thus giving a high signal-to-noise ratio. In the complete instrument the sensitivity can be switched in steps of ×2, ×5, ×10 to a maximum sensitivity of 12·5 μV full scale on the recorder. Full temperature control of both katharometer and column is provided.

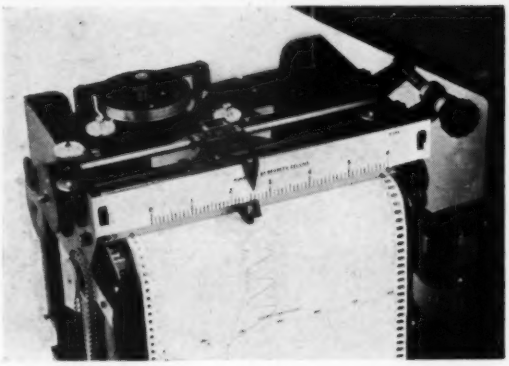
Gas chromatograph

An industrial gas chromatograph, Model 220, has been designed by Winston Electronics Ltd. for the continuous monitoring of industrial gas systems. Sample gas is continuously bled from a main process stream and led through the instrument's linear sample valve. Periodically, in response to the instrument's internal timing system, the valve transfers the contents of the "sample loop" to a constant stream of carrier gas. The sample is flushed through a chromatograph column, which, by means of absorptive or adsorptive granules, separates the gas into its component parts, each of which registers its passage through a thermistor sensing cell by changing the thermal conductivity of the carrier gas. A second thermistor cell, measuring pure carrier gas, serves as the second leg of a Wheatstone Bridge circuit. Signals from this are transmitted to a strip chart recorder where they are presented either as a spectrum of the entire mixture or as a bar graph of important components.

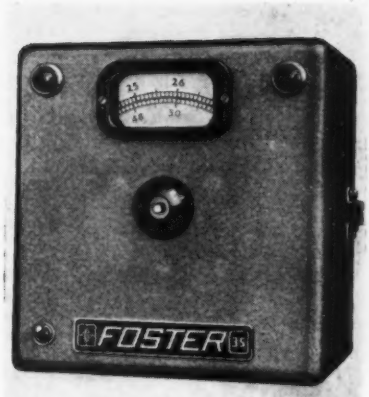
Recording and control

The Cambridge model DE electronic recorder is now supplied as a self-contained recorder/controller with sufficient power to operate multiple switches, slidewires, magslips, pneumatic transmitters and other similar control devices. Standard systems include various arrangements of electrical on-off control contacts, pneumatic proportional control with adjustable band width of 2-600%, and 3-term pneumatic control. A feature of the instrument is that the chart can be driven in one direction by a magslip receiver fitted in place of the usual chart motor, thus enabling a record to be plotted against a variable other than time.

Already supplied (in conjunction with Cambridge equipment) for temperature measurements, gas analysis, determination of *p*H values and calorific value of gases, detection of dissolved oxygen in boiler feed water, radiation intensity and other applications, this instrument is now available as a single-point recorder controller for industrial conductivity measurements (*i.e.*, boiler feed water, concentrated sulphuric acid manufacture, etc.). In the field of conductivity and *p*H electrodes for industrial applications three new designs are (1) A high-pressure electrode system (conductivity only) which will withstand the high pressures now encountered in industrial manufacturing processes. The measuring and reference cells, constructed from non-ferrous metals, are simply screwed into the pressure pipeline, without the necessity for any regulating valves or pressure-drop by-pass circuits. (2) A continuous flow electrode system (conductivity and *p*H) for measurements in solutions under low pressure (below 15 p.s.i.). Apart from the glass of the electrodes this unit is constructed entirely of *Vulcathene*, a material highly resistant to chemical reactions. (3) A submersible electrode system (conductivity and *p*H) for measurements where the solution is contained in open vessels. It is constructed on exactly the same lines as the continuous flow electrode, except that the lower



Cambridge Electronic recorder controller with chart mechanism swung out to reveal "desired" or "measured" valve pointers, pulley on top of differential control shaft and (on extreme right) "desired" valve adjustment.



Foster resistance thermometer controller Model 3510.

electrode cup is replaced by an open electrode guard.

The *Cambridge thermograph recorder/controller* is an inexpensive mercury-in-steel instrument and is representative of a comprehensive range of similar circular chart instruments which can be arranged to measure temperature, pressure, draught, humidity, and process time.

The instrument is basically a twelve-point on-off controller which can provide 2, 3, or multi-step action in conjunction with such varied regulating equipment as relays, micro-switches, motorised valves, magnetic valves, etc. The signal transfer medium can be air pressure, water pressure, or electrical energy.

In view of the many control combinations available, this type of recorder/controller is now capable of being tailor-made to individual requirements and, in addition, provides simple, reliable control at an economical cost.

An instrument recently supplied to the food preserving industry was specifically designed for the automatic control of cooking sequences of pickles in a steam-heated oven. For the first time as many as six midget "anti-chatter" relays were fitted inside the instrument case, together with additional devices such as re-set and trip switches. This arrangement effectively eliminated external wiring complications, a Satchwell motorised valve and a Klaxon alarm being the only regulating or warning devices installed any distance from the instrument. The case and the door have recently been redesigned.

The Cambridge Instrument Co. Ltd. have found that there are many similar applications involving the same variables in the chemical industry.

Temperature controller

The Foster Instrument Co. Ltd. have developed a resistance thermometer controller Model 3510 as a low cost, accurate and durable fully electronic temperature controller for use with special Foster fast response thermometer elements, which it is stated, provide a degree of control not normally obtained with standard elements. Temperature ranges cover from −50°C. up to +350°C. and the 15 in. long scale is overprinted with the equivalent Fahrenheit range. All resistances comprising the Wheatstone Bridge system are accurately calibrated and aged so that control point drift is eliminated. The control operates on a differential of 0·1°C., but can be detuned to operate on wider differentials (up to 5°C.) if required, by a simple adjustment of the sensitivity control. Variations in mains voltage within very wide limits do not affect the accuracy of the instrument. Electrical connections are simple and are made to terminals inside the instrument case. The dimensions are $8\frac{3}{16}$ in. × $7\frac{1}{8}$ in. × 5 in.

Process control installation

A comprehensive closed loop electronic process control installation applied to the process of extracting sugar from sugar beet has been installed at the British Sugar Corporation's factory at Wissington, Norfolk. It was designed by Evershed and Vignoles Ltd., in conjunction with the British Sugar Corporation.

The installation makes use of a variety of transducers for flow, level, temperature, etc., which provide an electric signal which is either applied to Evershed three-term process controllers, or used as an input to Evershed simple analogue computers. Several of these computers, which are completely integrated into the installation, are employed to provide an output signal which represents the continuous evaluation of the equation governing the part of the refining process to which they are applied. These computers, in conjunction with the three-term mode of process control, permit extremely fine control of the manufacturing process.

The electronic circuitry employed prevents ill effects caused by possible variations in the power supply, thereby ensuring an extremely stable performance of the installation as a whole.

The graphic control panel which forms the heart of the whole installation embodies a number of Evershed miniature recorders which will provide a permanent record of the performance of the plant, and will also furnish data for accountancy purposes, etc. The control panel also includes Miniplaques, so that bumpless transfer from automatic to manual operation of the plant, when desired, can easily be accomplished. An automatic alarm system, covering every vital part of the plant, also terminates at the panel.

In view of the complexity of the process controlled, use has been made of the Evershed *In-Line* scanner, which facilitates the supervision of the whole of the plant by a single operator, and which pin-points the location of any possible irregularity at once.

An interesting feature is the facility with which future extensions of the plant may be added to the present installation and incorporated at the control panel, without interference with the existing control arrangements.

General purpose *p*H meter

W. G. Pye and Co. Ltd. have designed this instrument to meet the demands for a medium-priced general purpose instrument giving ease of operation; all control is centred in a single knob. The range is 0-14 *p*H and provides direct reading on a 5 in. scale. The accuracy of the instrument does not depend on valve characteristics—a high degree of negative feed-back is used with the result that the linearity is almost perfect and the sensitivity is entirely unaffected by mains variation or valve changes. At the same time it has been possible to provide the very high sensitivity of 100 microamp/*p*H. Automatic temperature compensation (slope) is provided.

Vacuum moisture tester

A moisture-testing balance designed by Townson and Mercer Ltd. permits the estimation of moisture in many organic materials, with an accuracy of

±0·1%, in times varying from 2-12 min., depending on content and organic structure. Fibrous materials frequently give results in less than 2 min. while samples of shoe leather may require 10-12 min. It is possible to test, by various adaptations of the normal process, the total solids in rubber latex and similar liquids, and the fact that the scale reads 0 to 100% means that the tests can be done with the full-size sample. Since all the balance pans are tared, where very large quantities of tests have to be done, samples can be weighed out initially on another balance, using a number of pans, and then placed one by one in the instrument so that a very quick series of tests can be done.

A 5-g. sample is weighed on a torsion balance, in a vacuum, under a beam of infra-red light, and the loss in weight due to evaporation is measured, and indicated, as a percentage of contained moisture.

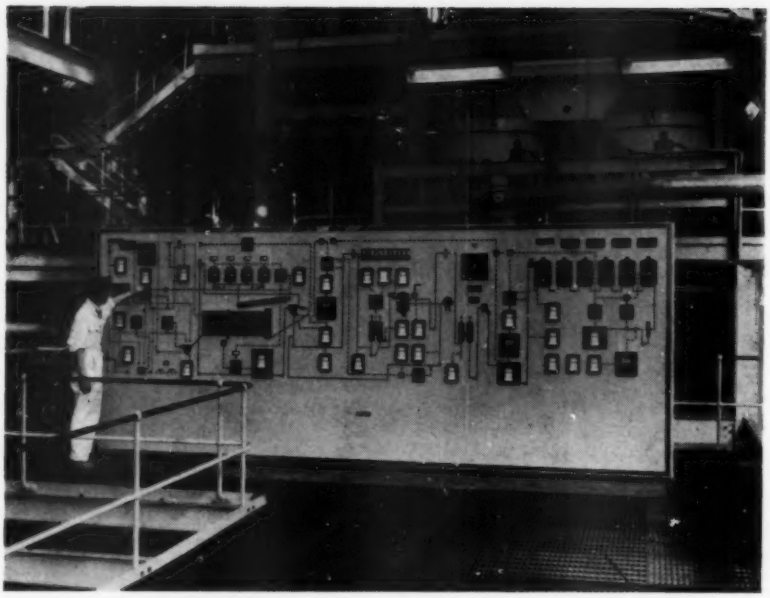
The heat comes from an infra-red lamp, with internal reflector, which is contained inside the vacuum chamber, and is adjusted to give a spread of heat evenly over the balance pan. The intensity of the beam can be adjusted from 250 watts maximum downwards, since certain substances require more gentle heating than others. As the moisture is evaporated, it is removed by the vacuum, which causes the moisture to be evolved not only more rapidly, but also at a lower temperature, so that many substances which tend to decompose under a normal infra-red drier can be safely tested. As the sample dries, the balance beam moves, and when it finally comes to rest, the pointer can be restored to zero by rotating a graduated dial. The pointer is observed against an index point and the actual percentage of moisture evolved can be read directly on the scale on the dial. Each division reads to 0·2% and estimation to 0·1% is practicable.

Apart from the speed and ease of operation of this type of instrument, it has the advantage that the weighing of the sample takes place actually in drying chamber in a vacuum. In ordinary moisture testing, the cooling of the sample and subsequent weighing on a balance always leads to certain errors from reabsorption of moisture, flour, for instance, absorbing up to 1% moisture in a very short time indeed. With other types of infra-red balance, not in a vacuum, there is always an error due to the updraught of the heated air which may rise to as much as 0·6% and is a slightly variable factor. When weighing in vacuum, this problem does not arise, with consequent increase in accuracy and reproducibility.

On the front panel there is a vacuum tap, a heater control, and a vacuum gauge. The vacuum tap has three positions, the first for evacuating, the second for holding the vacuum, and the third for releasing the vacuum. The cover, which incorporates the heating lamp, is counterbalanced and normally held down by a quick-action catch. It lifts right up to give easy access to the balance pan and, when down, seals on a semi-recessed perbunan ring so that there are no greasy joints to be maintained. The mechanism of the balance is protected by a removable plate through which projects the support for the balance pan and a locking device for the beam. This plate also prevents heat getting at the balance mechanism and the large mass of aluminium casting also stabilises the temperature of the sensitive parts. The plate bears the day-to-day working instructions. The pointer, with its zero index, is viewed through the glass cover at the back of the apparatus. This cover seals down on to a perbunan ring and is readily removed for cleaning if necessary.

The design of the instrument makes it possible for a laboratory assistant to replace a torsion wire if one is strained and to recalibrate the instrument. The adjustments are simple and spare wires can be supplied.

Dimensions are: back to front 19 in., width 17 in., overall height 18 in. It weighs 49 lb. complete and has a capacity of balance of 5 g. It is finished in stoved grey glossy enamel.



Evershed control installation at the British Sugar Corporation's factory.

Operation recorder

A permanent, visible and indelible record of operations and events is provided by the operation recorder developed by Fielden Electronics Ltd. This instrument was originally designed to work in conjunction with smoke density equipment and to record the time and duration of periods when industrial smoke was emitted. It has now found application in other industries where the recording of operations and events is required. It may be used for registering the on/off times of machines or electrical circuits, for showing the rate at which items are being produced in a repetitive process, and for recording the times when vehicles are in a particular area. In this last instance it is claimed that the instrument can be a great asset to a transport manager in effectively getting a quick turn round of men and vehicles. Again, when used for recording production this instrument can be complementary to a counter. The counter gives only the total number produced over a given period, whereas if this is related to the recorder the rate of production at various periods during the day may be ascertained.

Two charts are available for the operation recorder, one being a 24 hr. chart and the other seven-day. In the former case the chart is driven at a speed of one r.p.h. and the pen traces a spiral of 24 turns. The seven-day chart is driven at a speed of one rev. in 24 hr., making seven complete rev. on the chart. In both cases the chart is of specially prepared heat-sensitive paper and an "inkless pen," consisting of a heated stylus, draws an indelible trace upon it. The pen is energised from a low-voltage source and has a power consumption of less than one watt. Both pen and chart are driven by self-starting synchronous 50 c/s clock motors.

The only external equipment necessary is a pair of contacts which will make when it is required to produce a trace on the recorder, and these contacts should be capable of handling the power required by the pen. When the

contacts are closed and the stylus is heated, a black line approximately $\frac{1}{16}$ in. wide is produced. During the off periods a lower voltage is applied to the pen producing a faint, thin line on the chart. The difference between these lines is clearly visible, but the thin line does enable the trace to be followed even though no operations have been recorded.

The operation recorder is supplied in a die-cast aluminium case with a chart approximately 10 in. diameter and is designed to operate from a mains supply of 230 v., 50 c.c., single phase. The single point model is priced at £29 17s. 6d. Multi-point recorders are also available.

Accessories for spectrophotometry

The Hilger H800 infra-red spectrophotometer, a double-beam recording instrument, has several new attachments.

A micro-illuminator, unique in being of double-beam construction, makes the instrument suitable for studying minute samples. Single fibres, tiny drops of liquid, small crystals, and so on, can be examined with it.

Also for double-beam work, a polarizer uses thin selenium films and is very compact and light. Infra-red spectropolarimetry is valuable in investigating crystal structure and is complementary to X-ray crystallography.

A reflectance attachment is suitable for comparing the infra-red reflectivities of different substances.

Gratings can now be used in place of the various interchangeable prisms of the instrument. They give greater dispersion than rock-salt prisms and are cheaper than, say, lithium fluoride prisms. F-centre filters are used to remove unwanted orders.

An integrator automatically measures the charted area of an absorption band, which area is virtually independent of slit-width and depends almost solely on the absorption characteristics of the sample.

A new printed chart, for recording percentage absorption against wavenumber, is now available for the instrument.

The Hilger Uvispek spectrophotometer for the visible and U.V. regions has aequired two new accessories.

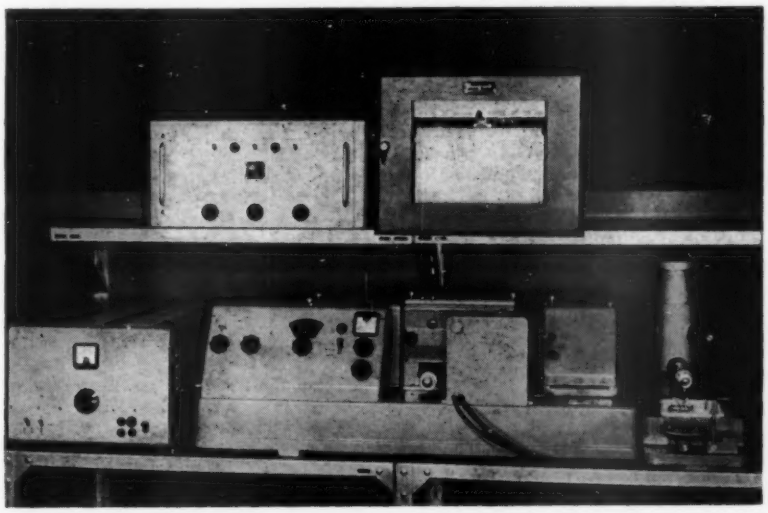
One is a photomultiplier attachment, which greatly increases the sensitivity of the instrument and makes it even more suitable for flame photometry. The photomultiplier takes the place of one of the two photocells normally in the instrument; the other can still be used as in the past. A strip-chart recorder can be used with the attachment.

The other accessory is a prism of fused silica, interchangeable with the quartz and glass prisms. The prism is much more transparent than quartz to the shorter wave-lengths, and extends the range of the instrument down to 1850 Å. It can be used with all but the very earliest models of the Uvispek (*i.e.*, with all Uvispeks of series number 303 or later).

Electrolytic hygrometer

This simple instrument has been made by Winston Electronics Ltd. for the continuous or batch measurement of water content down to 1 p.p.m. in gaseous or vapour samples.

Analyses are made by continuously absorbing and electrolysing any and all water present in a sample stream entering the instrument's analysing system. Gas streams of up to 100°C. can be handled. An alarm system can be set for any point in the instrument's range. Either a 10 or 50 mV standard potentiometric recorder or recorder-controller can be operated from the hygrometer output, making possible the continuous monitoring of water vapour in plant process stream. High concentrations of water in gases can be measured through use of dilution techniques. Liquid systems may be measured by dry nitrogen stripping.



The Hilger and Watts Uvispek spectrophotometer with photomultiplier attachment set up for flame photometry.

Potentiometric titration

The advantages of the potentiometric titration method of volumetric analysis are emphasised in cases where no chemical indicators are known or where they exhibit a poor colour change, have a high indicator error, or where the colour of the solution obscures the indicator.

Mullard Ltd., in collaboration with A. Gallenkamp and Co., have produced a composite titration equipment, a feature of which is the incorporation of a cathode ray tuning indicator as an indicating device in place of a galvanometer. The apparatus can also be used for *p*H determination with the use of metal electrodes.

The potentiometer unit E.920/2 is mains operated, and a single interconnecting cable supplies the stirring motor and indicator on the titration stand, as well as providing connection to the electrode system. A second indicator is mounted on the potentiometer, which can therefore be used as an independent unit if required. There are no batteries to be replaced, and no delicate galvanometer to be damaged by mechanical shocks or electrical overloads. A special circuit eliminates drift during titration, and changes of mains supply voltage do not give rise to inaccuracies.

By means of a 100 c/s vibrator the voltage from the electrodes and an internal reference voltage are alternately applied to an amplifier followed by the cathode ray indicator. When the two voltages are equal the input to the amplifier is zero. In practice the e.m.f. from the standard half-cell and the indicator electrode in the solution is supplied to the potentiometer unit, and the main control is adjusted until the area of fluorescence on the screen of the indicator is a minimum. The value of the e.m.f. is then read directly from the calibrated scale. A sensitivity control is provided, and at maximum sensitivity a change in potential of 2 mV can be detected. The main dial covers the range 0-400 mV, while a five-position switch enables the range to be extended to a maximum of 2 volts. Another switch controls a subsidiary circuit, which provides a polarizing voltage for use with polarized platinum electrodes.

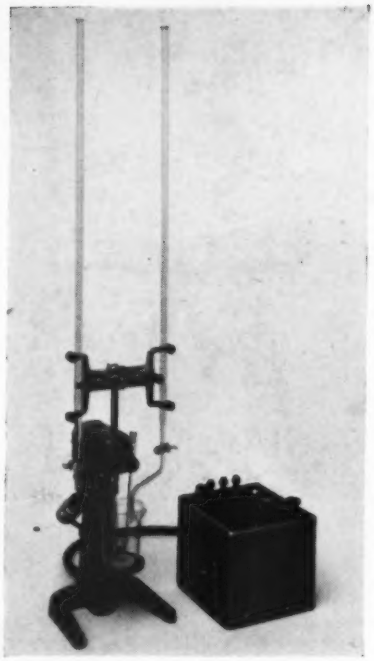
The Titration Unit E.921/G has been designed for convenience of operation, and the finish on all parts is chosen for good chemical resistance and easy maintenance. The stand has a heavy U-shaped base with a hollow upright

member and integral cast head which has a detachable cover for maintenance purposes.

Two electrodes are mounted at the front of the head and a stirring shaft is fitted immediately behind. An electric motor mounted at the rear drives the stirrer by a short belt. Stirring is almost noiseless and there is a choice of two fixed speeds from a stepped pulley on the motor shaft. Mains supply for the motor is obtained from the potentiometer unit.

A double burette holder is clamped to a vertical rod extending from the electrode head. This supports two burettes in a truly vertical position, while providing an instantaneous grip and release. The holder does not obscure any graduations. Specially made left- and right-hand burettes are supplied, having cranked jet tubes to bring them close together. Each has a 50 ml. capacity and is subdivided in $\frac{1}{10}$ ml. The use of two burettes allows one to be used for back titrations.

The end point of the titration is detected by a cathode ray indicator, mounted in an adjustable holder fitted to the side of the stand. This arrangement allows the indicator to be placed as near as possible to the burette jets, so that both can be observed simultaneously.



Pofentiometric titration apparatus by Mullard.

Ultrasonic cleaning

The standard of purity of chemical compounds demanded nowadays is so high that the cleaning of production equipment has become a major problem. Especially cocks, valves, extrusion nozzles and similar parts of glass or metal plant are difficult to clean thoroughly because of their complex shape, and even smooth surfaces present a difficulty where chemical cleanness is concerned.

A new approach to this problem is presented by Dawe Instruments Ltd. who recently introduced Type 1150 ultrasonic cleaning equipment. This consists of a generator producing an ultrasonic signal and transducers which convert the signal into mechanical vibrations. The transducers are mounted at the bottom of a tank containing water or some suitable solvent, in which the vibration gives rise to "cavitation." This is a condition in which millions of tiny bubbles are created and collapse almost immediately, thus causing a strong but gentle scrubbing action on the surface of any object dipped into the tank.

Multi-coloured recording

Ellams Duplicator Co. Ltd. have developed a means of producing typewriter ribbons with as many as six different coloured stripes.

Their main industrial use will be in recording instruments, such as indicating different temperatures of a furnace on a graph. As the temperature rises or falls the needle of the recording instrument will graph in a different colour. When critical temperatures are reached, the situation can be appraised quickly by supervisors. Other uses are being considered.

Ribbons are at present being made in widths of $\frac{1}{2}$ in., $\frac{9}{16}$ in. and $\frac{3}{4}$ in.

Radioactive tracer equipment

The Scintillometer used in uranium and oil prospecting and since 1949 as a tool in nuclear physics laboratories now promises to be useful in the control of manufacturing flow processes.

Nuclear Enterprises (G.B.) Ltd. have obtained a contract for the production of the first multi-channel industrial tracer scintillation spectrometer to be made in Europe.

The advantages of being able to follow the progress and behaviour of one or more selected raw materials or ingredients simultaneously through the pipeline of processing and mixing at any stage of manufacture, and to locate trouble at the precise point where no visual means exist, will be at once recognised to have important applications to any industry concerned with flow and mixing techniques. The application is known to be effective in the chemical, paper and pulp industries in Scandinavia where government bodies have at once recognised its significance.

The system would appear to be of great importance to the food and drink trades and is already used experimentally by a firm in the fertiliser industry. It can also be used in assaying.

Short-lived radio-isotopes are used in this equipment. Usually only γ radiation of the tracer is counted, and an analysis is made of the intensity and energy of this radiation. Where the labelled material or substance flows in open ducts or conveyors, however, β counting may be applied. The same holds for samples taken from different parts of the process.

Measurements are carried out in normal industrial conditions and if conditions of high humidity, moderately high temperatures or dusty atmosphere exist, these are taken into account in the design. The scintillation ratemeters used are suitably protected and can be portable. The instruments are normally constructed in two parts, (1) the scintillation detector proper which can be placed on pipes, conveyors or troughs, and (2) the auxiliary electronics containing ratemeter, controls, current supply and recorder, all of which can be placed up to 1,000 ft. from the detector if desired. Where it may be necessary to provide an auxiliary automatic counter in connection with the channel analyser, the instrument can be battery-operated. The complete equipment, portable in a case built for rugged conditions of work, could weigh as little as 40 lb., the recorder cable being carried separately.

The flow pattern of materials may be studied by means of these "radiotracers." A portion of the material to be studied is tracered with a gamma ray isotope so that its movement may be followed with a scintillometer outside without disturbing operations. One application of this system is the use of catalyst beads in continuous circulating systems of catalytic cracking plants. The beads are tracered to detect deviations from the normal flow pattern and to forecast shut downs which might become necessary. Other applications recently made have been to measure relative loads carried by parallel pipes in refining plants; to appraise baffle plate systems designed to promote uniform flow; and to trace the blocking of channels in distillation units.

Sulphur content apparatus

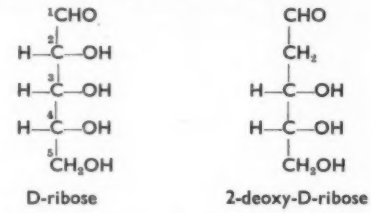
The determination of sulphur content of oils, greases, tars and other similar substances is automatically carried out by a new Pye apparatus. At certain temperature values, sulphur in the oil burns to sulphur dioxide, which is passed to a titration cell. Automatic titrators, together with a *p*H meter/millivoltmeter, control the addition of reagent from a burette, until all the sulphur dioxide has reacted. At the end of a run, the total sulphur content can be assessed directly from the volume of titrant added.

The Synthesis of 2-deoxy-D-ribose

CHOICE OF METHODS FOR COMMERCIAL EXPLOITATION

By Greville Machell, B.SC., PH.D., A.R.I.C.*

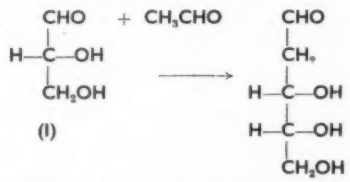
AS ITS name would suggest, 2-deoxy-D-ribose contains fewer oxygen atoms than the five carbon atom sugar D-ribose. The relationship between the two compounds is illustrated by the open-chain formulæ:



2-deoxy-D-ribose is the carbohydrate constituent of a large number of nucleic acids derived from the cells of animals, plants and bacteria, and is therefore of considerable biochemical importance. In these nucleic acids the 2-deoxy-D-ribose is linked to phosphoric acid and to organic bases of the purine or pyrimidine type, examples being adenine and thymine. It is very difficult to isolate the deoxy-sugar from nucleic acids by chemical methods, and this may be due in part to the degradation of the sugar itself when the sugar-base link is broken by acid hydrolysis. However, recent enzymic degradation methods have given superior results, particularly when aided by the modern techniques of ion-exchange and chromatography.

For synthetic work, there has been an increasing demand for 2-deoxy-D-ribose, and many workers in the carbohydrate field have devoted their attention to devising a convenient synthesis for this hitherto rare sugar. Commercial interest has been aroused, with the result that 2-deoxy-D-ribose is now commercially available both in this country and North America.

There has been much speculation as to the nature of the biosynthesis of 2-deoxy-D-ribose which must presumably take place in cell nuclei, since these are the source of the deoxy-ribonucleic acids. Hough and Jones[1] have suggested that the sugar could arise by an aldol type of condensation between two feasible precursors: acetaldehyde and D-glyceraldehyde (I):

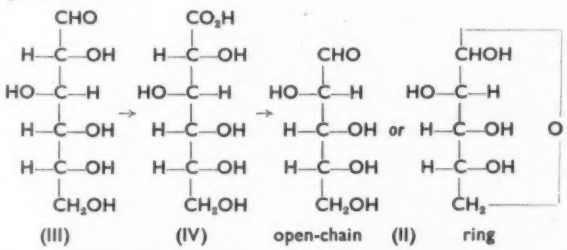


Some experimental evidence has been adduced which favours a mechanism of this type.

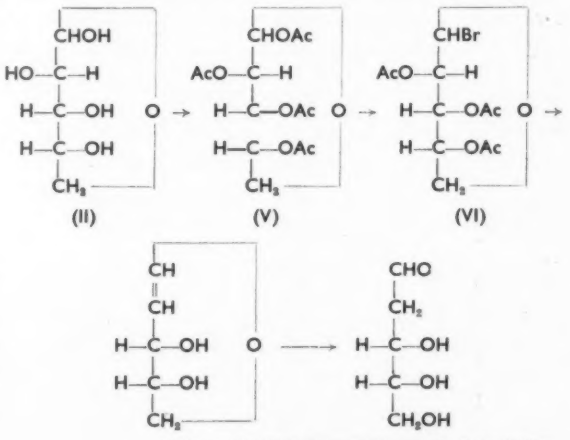
An account is now given in chronological order of several syntheses of 2-deoxy-D-ribose, all except one of which have been first reported within the last seven years. It is clear that the starting material should be readily accessible, and for this reason the majority of workers have chosen one which can in turn be made conveniently from D-glucose. The latter is readily available in a pure state, and is inexpensive.

The Glycal method

The Glycal method has been widely practised until recent years and was evolved by Fischer.[2] Numerous modifications have been made by other workers during the ensuing 40 years, and these have resulted in increased yields of a purer product. The starting material here is D-arabinose (II), which unfortunately does not appear to occur in nature. However, D-arabinose has the same structure as the lower five carbon atoms of D-glucose (III), and therefore any method which will remove the terminal carbon atom from D-glucose will afford D-arabinose. Probably the most convenient way of achieving this end is to first oxidise the glucose to gluconic acid (IV) with bromine water, and then degrade the calcium salt of this acid by a modified Ruff procedure using hydrogen peroxide and ferric sulphate[3]:



In order to follow the synthesis proper, use will have to be made of the ring formula of D-arabinose, which is shown adjacent to the open-chain form above. The D-arabinose was fully acetylated using acetic anhydride and sodium acetate, and the tetra-acetyl derivative (V) brominated with hydrogen bromide in acetic acid. Under these conditions, only one of the acetyl



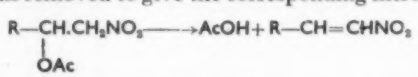
* British Rayon Research Association.

groups was replaced by bromine, and the resulting acetobromo-derivative (VI) was then reduced with zinc dust in acetic acid, and the acetyl groups removed, affording D-arabinal (VII). It is this compound which gives its name to the method, since it is a member of a series of compounds known collectively as the glycals. All that now remained was to add the elements of water to the olefinic linkage in D-arabinal, and this was readily brought about by treatment with dilute sulphuric acid.

The most recent account[4] of the application of this method records the yield of 2-deoxy-D-ribose as 10% of the theoretical, based on D-arabinose.

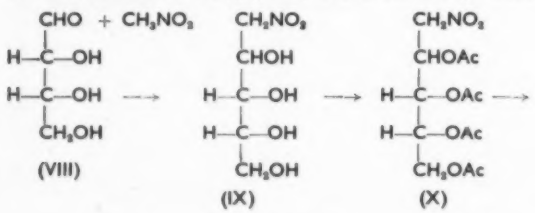
The nitro-olefin method

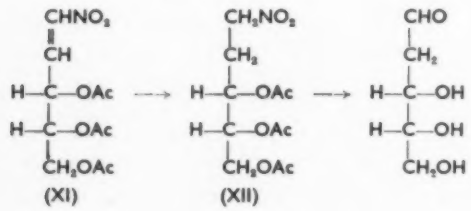
This method, which was first investigated simultaneously on both sides of the Atlantic,[5] makes use of an interesting general reaction discovered by Schmidt and Rutz.[6] These workers found that when an *α*-acetoxy primary nitroparaffin was treated with potassium bicarbonate in a non-polar solvent such as ether, acetic acid was removed to give the corresponding nitro-olefin:



The starting material for the nitro-olefin synthesis of 2-deoxy-D-ribose is the four carbon atom sugar D-erythrose (VIII). Unfortunately, this sugar does not occur naturally, and Sowden obtained it from D-glucose by first converting the latter to its 4 : 6-benzylidene derivative, reducing this to the corresponding glucitol, and oxidising the glucitol with sodium metaperiodate. An alternative approach also follows from the fact that D-erythrose has the same structure as the lower four carbon atoms of D-glucose. The two unwanted carbon atoms were removed by a stepwise application of the Ruff degradation mentioned earlier; Stacy *et al.* concluded that this method was superior to the procedure of Sowden.

D-Erythrose was condensed with nitromethane in the presence of sodium methoxide to give an arabitol derivative (IX). Acetylation of the latter afforded the tetra-acetyl derivative (X), and when this was heated with sodium bicarbonate in benzene, acetic acid was eliminated. The resulting nitro-olefin (XI) was then reduced with hydrogen in the presence of a catalyst, and hydrolysis of the nitroparaffin (XII) formed removed the nitro- and acetyl groups affording 2-deoxy-D-ribose in about 20% yield, based on D-erythrose:



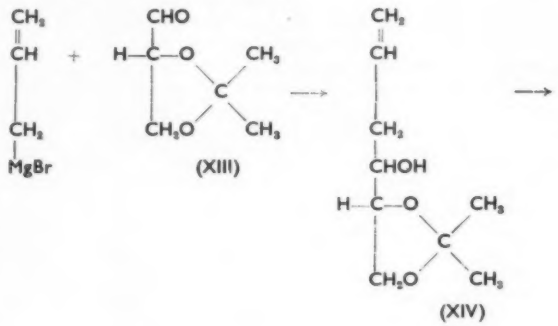


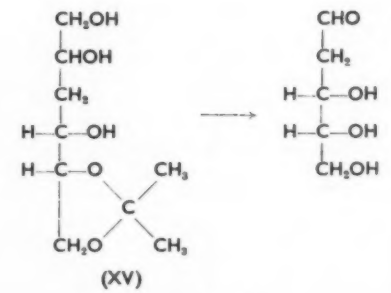
This method when published had little appeal owing to the low yield of the starting material, D-erythrose obtainable from D-glucose, and that only by a tedious route. Recently, a synthesis of D-erythrose has been announced[7] which afforded an 80% yield of the pure tetrose, and which was achieved by oxidation of D-glucose with 2 moles of lead tetra-acetate. However, this valuable advance came too late to give the nitro-olefin method any practical significance.

A Grignard synthesis and a simulated biosynthesis

D-glyceraldehyde, with its three carbon atoms, can be considered as the simplest optically active member of the sugar series. Two syntheses have been devised for the addition of the two carbon atoms required to convert it into a ribose derivative.

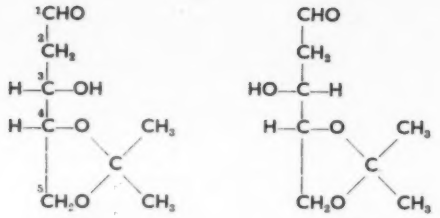
In Hough's method[8] the source of the carbon atoms was the Grignard reagent allylmagnesium bromide, which was reacted with 2 : 3-*iso*propylidene-D-glyceraldehyde (XIII) in ethereal solution. Decomposition of the resulting complex afforded 5 : 6-*iso*propylidene-1-hexene-4 : 5 : 6-triol (XIV):





Treatment of the triol with hydrogen peroxide caused hydroxylation of the double bond with the formation of a number of products, including the desired 5 : 6-*iso*propylidene-3-deoxy-hexitol (XV). The latter was separated by column chromatography, the terminal carbon atom oxidised away by sodium metaperiodate, and the *iso*propylidene group removed by hydrolysis. A very low yield of crude 2-deoxy-D-ribose resulted.

A second synthesis starting from 2 : 3-*iso*propylidene-D-glyceraldehyde, and due to Overend and Stacey,[9] is the laboratory equivalent of the suggested enzymic synthesis of 2-deoxy-D-ribose to which reference has already been made. The starting material was condensed with acetaldehyde in the presence of anhydrous potassium carbonate to give a mixture of 4 : 5-*iso*propylidene - 2 - deoxy - D - ribose (XVI and -xylose (XVII):



(XVI) (XVII)

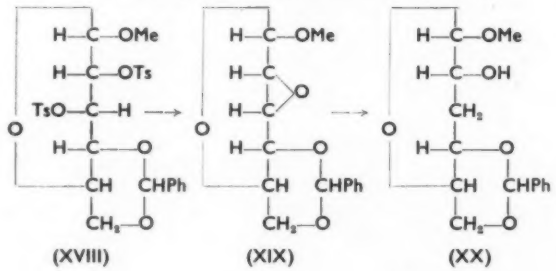
which are seen to differ only in the configuration of carbon atom No. 3. Hydrolysis of this mixture with dilute acid afforded the two free deoxy-sugars, which were separated by column chromatography.

The starting material for these two syntheses is quite readily prepared by the oxidation of 1 : 2, 5 : 6-*iso*-propylidene-D-mannitol, but unfortunately both methods give low yields, and are made even less attractively the need for a chromatographic separation.

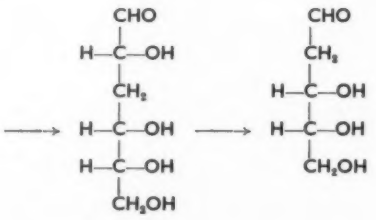
The anhydro-sugar method

This synthesis is really a combination of three separate syntheses, for which the initial starting material is D-glucose. Richtmyer and Hudson[10] showed that when the 2 : 3-di-*p*-toluene-sulphonyl ester (XVIII) of the well-known glucose derivative methyl 4 : 6-benzylidene-*α*-glucoside was treated with sodium ethoxide, the *p*-toluenesulphonyl groups were eliminated with the formation of 2 : 3-anhydro-4 : 6-benzylidene-*α*-methyl-D-alloside (XIX). Prins[11] then found that hydrogenation of this anhydro-sugar in the presence of Raney nickel afforded 4 : 6-benzylidene-3-deoxy-*α*-methyl-D-glucoside (XX), which on hydrolysis gave 3-deoxy-D-glucose (XXI):

Note: Ts—represents the *p*-toluenesulphonyl group.



(XVIII) (XIX) (XX)



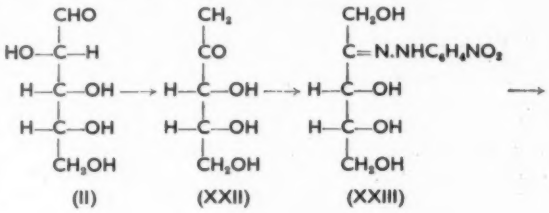
(XXI)

The desired product could then be obtained by removal of the terminal carbon atom, a result which has been achieved in two ways. Overend and Stacey[12] report the oxidation of 3-deoxy-D-glucose to the corresponding acid using bromine water, and the subsequent degradation of the calcium salt of the latter by Ruff's method. Gorin and Jones[13] carried out the oxidation directly with sodium metaperiodate under carefully controlled conditions, and obtained a mixture of 2-deoxy-D-ribose and unchanged starting material, which had to be separated by large-scale paper chromatography. The latter workers obtained a yield of 30% based on 3-deoxy-D-glucose.

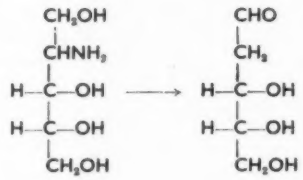
This combination of syntheses has proved to be of academic interest only, owing to the low yields produced and the need for chromatographic separation in one of the variations.

The amino-alcohol method

A second synthesis using the same starting material as the Glycal method was devised by Matsushima and Imanaga.[14] The D-arabinose (II) was converted to the isomeric keto-sugar D-ribulose (XXII) by heating it with pyridine. The D-ribulose was isolated as its *o*-nitrophenylhydrazone (XXIII), which was reduced with hydrogen in the presence of Raney nickel to the amino-alcohol, 2-deoxy-2-aminopentitol (XXIV). In the final step, described as a " semipinacolonic deamination," the latter was treated with nitrous acid. As the yield of 2-deoxy-D-ribose was only 3%, this approach proved to be inferior to the Glycal method.



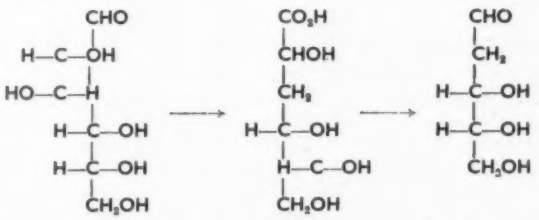
(II) (XXII) (XXIII)



(XXIV)

The saccharinic acid methods

It was shown by Nef[15] that when D-glucose (III) was degraded in concentrated sodium hydroxide at 100°C., a mixture of acids was produced, one of these acids being D-gluco*meta*saccharinic acid (XXV). About 20% of the glucose was converted to this acid, which has the same molecular weight as glucose, and is in fact a structural isomer. The acid was isolated in a pure state by neutralisation of the alkali, followed by a rather tedious fractional extraction with ether and ethyl acetate.



(III) (XXV)

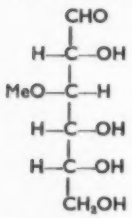
Sowden[16] has used this acid as a source of 2-deoxy-D-ribose. He prepared the acid from glucose as above, but used a modified method for its isolation. The calcium salt of D-gluco*meta*saccharinic acid was then degraded by the Ruff method, when the terminal carbon atom was removed.

The yield of 2-deoxy-D-ribose based on the original glucose was about 6%.

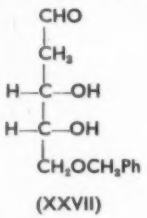
Venner[17] has criticised the experimental procedure used by Sowden, and has shown that by using an alternative method the overall yield can be brought up to nearly 10%.

At the same time that Sowden made known his results, Richards[18] announced a similar synthesis based on D-gluco*meta*saccharinic acid, but he obtained the latter from D-glucose by a different route. Kenner and Richards[19] had shown a little earlier that 3-methyl-D-glucose (XXVI) was degraded on treatment with lime water to D-gluco*meta*saccharinic acid *only*, and that a similar result was also obtained from any glucose, mannose or fructose derivative substituted on the 3-carbon atom, and from any polysaccharide (for example, laminarin, the seaweed polysaccharide) in which the glucose units are held together by 1 : 3 linkages. Richards favoured the use of 3-methyl-D-glucose, which can itself be readily obtained from D-glucose in 60% yield.[20]

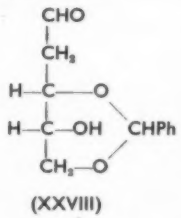
Degradation of 3-methyl-D-glucose in lime water gave an excellent yield of calcium D-gluco*meta*saccharinate, which was then directly degraded further using the Ruff procedure, to give 2-deoxy-D-ribose in 18% yield, based on the original glucose. This result was superior to that obtained by Venner, although there are additional steps involved in preparing the 3-methyl-D-glucose. Only traces of impurities were present in the product, which was said to be suitable for most synthetic purposes without further purification.



(XXVI)



(XXVII)

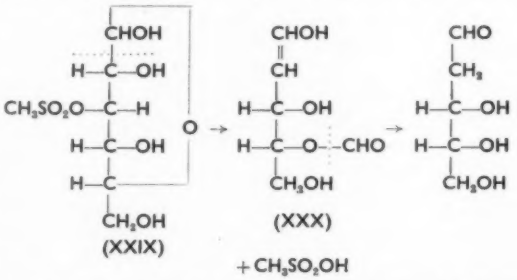


(XXVIII)

The method of Richards has a further advantage over that of Sowden in that it is readily adapted for the production of derivatives of 2-deoxy-D-ribose. Thus Kenner and Richards[21] have prepared 5-benzyl- (XXVII) and 3 : 5 - benzylidene - 2 - deoxy - D - ribose (XXVIII) starting from the appropriate glucose derivatives. Such derivatives of 2-deoxy-D-ribose are of potential value in the synthesis of deoxyribonucleic acids.

The methanesulphonyl ester method

Shortly after the publication of Richards' method, Smith[22] announced another most promising synthesis with D-glucose as the starting material. This was converted to the 3-methanesulphonyl derivative (XXIX) by a procedure analogous to that employed for the preparation of 3-methyl-D-glucose. While the latter gave D-gluco*meta*saccharinic acid in alkali, the former, when treated with 2 moles of sodium hydroxide at room temperature, afforded crude 2-deoxy-D-ribose directly. A small amount of unchanged starting material was removed by column chromatography, after which the yield of the amorphous, slightly impure, sugar was 55%, based on the 3-methanesulphonyl ester. The mechanism of this unusual reaction was not definitely established, but it was suggested that the elimination of the methanesulphonyl group was accompanied by the breaking (shown dotted) of a carbon to carbon bond:



+ CH_3SO_2OH

The intermediate was the enol form of 2-deoxy-4-formyl-D-ribose (XXX), which then rearranged to the normal keto form while the formyl group was hydrolysed off by the alkali. Consumption of 2 moles of alkali was accounted for by the formation of 1 mole each of formic acid and methanesulphonic acid.

It has since been shown by Kenner and Richards[23] that the yield of 2-deoxy-D-ribose can be increased to 65 to 70% by replacing the sodium hydroxide with lime water, and by improvements in the chromatographic technique. Furthermore, the product then obtained was of a high degree of purity, and could be crystallised.

Further developments of this method seem likely, and these may perhaps eliminate the present need for chromatographic purification of the product.

Conclusion

The Glycal method of Fischer has been the most widely practised method for the synthesis of 2-deoxy-D-ribose, in spite of the development of numerous other approaches to the problem as the field of carbohydrate chemistry has attracted increasing numbers of research workers. After many years, however, the Glycal method has finally been abandoned in favour of those methods which are based on D-gluco*meta*saccharinic acid or 3-methanesulphonyl-D-glucose. At the present time, the method of Richards and Sowden is probably to be preferred for commercial exploitation, and this method is in fact being used for the commercial synthesis of 2-deoxy-D-ribose. However, for smaller scale laboratory preparations, and where the apparatus for column chromatography is available, Smith's method will be favoured.

Meanwhile, the search for still more satisfactory syntheses will no doubt be continued, in view of the great interest being shown in the rôle of 2-deoxy-D-ribose as one of Nature's building units.

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(*Continued on page* 37)

Photographic Film Research

ILFORD LTD. OPEN NEW LABORATORIES AT BRENTWOOD

The new Ramsden Laboratories from the east end, with the main production despatch block behind.

A FURTHER step in the rapid growth of Ilford Limited is a new research laboratory at their photographic film factory at Brentwood, Essex. With a total floor area of 30,000 sq. ft., the laboratories provide a comprehensive range of facilities for research on film. They cost £300,000 to build and equip and now employ a staff of 130, including 40 graduates; eventually 170 people will work in them. They have been named the Ramsden Laboratories in memory of a former Ilford director, Colonel Ramsden. On Friday, December 6, they were inspected by the Duke of Edinburgh.

During a visit to the new premises Mr. W. H. Dimsdale, M.A., managing director of Ilford, told us that his company is the sole British survivor in an industry based entirely on a British invention—the invention of the dry photographic plate in 1878. It began in 1878 and was registered as a limited company—the Britannia Works Co.—20 years later. It became Ilford Limited in 1900.

The company now employs about 4,000 people in England and another 500 abroad. It makes the complete range of photographic films, X-ray films, photographic papers, photographic chemicals, equipment and accessories for the photographer and cinema industry, photo printers and reproducers, and components such as spools, cartons and packings, and spare parts for equipment.

The company makes all its own film base—cellulose triacetate, which is non-inflammable—through a subsidiary owned jointly with BX Plastics Ltd. This factory cost £2 million and is located at Brantham, Essex. Before the war all film base had to be imported from America or Belgium. Since film base is the most expensive raw material in a film, accounting for 20% to 30% of its cost, these imports were a heavy drain on foreign currency. By making it themselves, Ilford claim they save nearly $6 million a year and are now actually selling film base to the U.S.

Ilford's home sales amount to about half the film made in Britain, two-thirds of the photographic plates and about one-third of the photographic paper. Their exports account for about 55% of all Britain's photographic exports and a large proportion goes to Canada and the U.S. The company are pre-eminent in the field of X-ray film and are gaining a large share in the expanding market for television film.

Another rapidly growing market is for colour prints; Ilford were the first concern in England to offer a print of postcard size for 2s. 6d. The existing colour-printing works at Richmond, Surrey, are to be moved to larger premises at Basildon, Essex. The company's main factories are at Ilford, Essex (photographic plates and the head office), Brentwood (films), Mobberley, Cheshire (photographic papers—a big extension is being built to take over part of the paper manufacture now at Park Royal, London), Watford, Herts (*Azoflex* copying equipment and photographic chemicals) and Brantham, Essex (film base).

Construction and equipment of laboratories

The Ramsden Laboratories have been designed to minimise two great problems in film manufacture —dust and light. A standard of clinical cleanliness is maintained by the use of plastic floor tiles and p.v.c.-sheet wall finish. Special protective paint is used on walls of laboratories handling chemicals and in the dark rooms, where wet processes are important, the floors and walls are lined with asphalt. Unit laboratory furniture is used and the tops of benches and shelves are faced with chemical-resistant melamine plastic. Sinks are lined with rubber and there is a special drainage system for carrying away

and treating wastes which contain silver residues to recover the silver. The laboratories are fully equipped with piped supplies of gas, compressed air, vacuum, hot, cold and chilled water, distilled water, steam and low-pressure hot water for central heating.

The dark rooms are mechanically ventilated and equipped with special "safelights." These consist of clusters of three differently coloured lights. If the material is sensitive to blue light the safelighting is amber; if sensitive to blue and green, safelighting is red; if sensitive to the whole spectrum (panchromatic), safelighting is very dim green. The laboratories are divided into three groups dealing respectively with chemistry, physics and testing.

Laboratory devoted to the use of polarographic technique. Pen recording polarograph is shown left and cathode ray polarograph on right.

Chemistry

This section comprises a series of laboratories with adjoining dark rooms. The equipment is, in many cases, of completely new design. Gelatin is the most important raw material of photographic emulsions which are, more correctly, dispersions of silver salts. Being a natural raw material, gelatin is susceptible to many variations in quality and performance. A great deal of time and effort is devoted to minimising these variations and improving the photographic properties of gelatin. Three methods used for this work are spectrophotometry, chromatography and polarography, separate laboratories being devoted to each operation. A special apparatus is used to check the hardness of coated film; the film is passed through a heated water bath and then scratched with a glass rod; the melting-point is taken to be the point when the emulsion smears. This is a standard test.

U.V. spectrophotometry is used for such purposes as testing dye solutions and for estimating tyrosine in protein. Chromatography is used for estimating the concentration of protein in gelatin. To differentiate proteins they are hydrolysed to amino acids and determined by paper chromatography. The chromatography laboratory is maintained at a constant 70°F.±2°.

Two polarographs are used: a pen recording instrument and a cathode ray instrument. Polarography is used, for instance, to detect photographically important impurities in gelatin. For this purpose gelatin is prepared by shredding, extraction, filtration and concentration of the extract in a Craig rotary film evaporator.

One laboratory is used for studying the thixotropic behaviour of gelatin. Colour film is coated with layers of emulsion and it is important to ensure that successive coatings do not fuse with each other. This is done by determining the re-melt temperature of gelatin. Coating is improved by adding wetting agents to gelatin.

Microscopy is an important tool of research in emulsion technology. In a special laboratory equipment is provided for taking photomicrographs with magnifications ranging from × 20 to × 2,500. It is thus possible to photograph the grain size of emulsions and to detect clumping of crystals in emulsions. The relative thickness of film and its coating of emulsion is shown by photomicrographs of sections of the film.

Emulsion laboratories

The emulsion laboratories are equipped with miniature apparatus for making emulsions and applying them to film base. In a demonstration, ammonium bromide and silver nitrate were stirred into a solution of gelatin, the ammonium bromide being present in excess to "ripen" the silver bromide crystals, *i.e.* to make them grow. (In general the larger the grains of silver bromide the faster is the emulsion; however, this is accompanied by graininess of the film and the objective is to reach a compromise between speed and grain size.) After mixing the emulsion was set, shredded and washed with water to eliminate excess ammonium salts. Sensitising dyes were added to complete the emulsion. The film base was then coated by passing it through a reservoir of emulsion. It was then chilled to harden the coating.

Physics

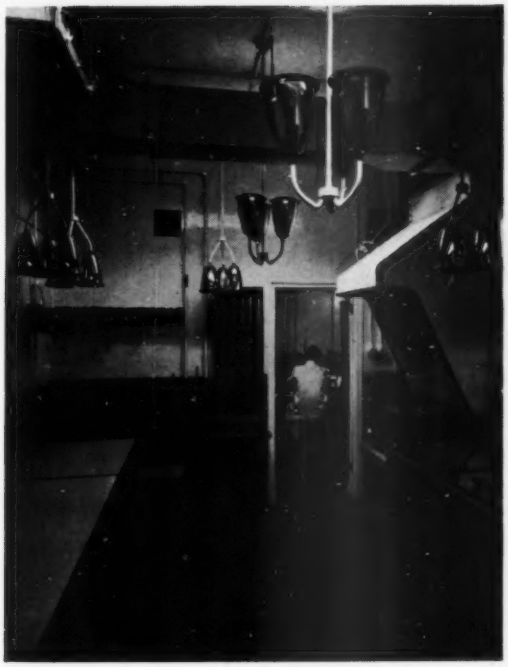
This section investigates photographic materials, processes like coating the emulsions on film base, and special problems of colour photography, the most rapidly expanding field of development.

The physics section includes a drawing office and workshop for making new materials and machines. An electronics shop services the mass of electrical equipment used throughout the laboratories.

People working with colour photography must, of course, have good colour vision. An interesting machine — the anomaloscope — is used for testing colour vision, the subject having to match two colours by altering brightness.

Electronic duplication of colour transparencies

The most interesting machine in the physics section is an electronic



A typical emulsion laboratory equipped for the preparation of experimental photographic emulsions.

machine for printing colour transparencies. It has been invented by Ilford. In the present method of duplicating colour transparencies a black and white negative is used to mask the transparency; the printing is done through this mask in order to preserve details of highlights and shadows which otherwise would be lost by the increased contrast. It would be possible to reduce the contrast by alternative methods, but this would degrade the colours and give a flatter picture. The negative system raises problems of exact register and other difficulties and is generally tedious and expensive. The new machine uses television techniques to produce the negative mask. In effect the transparency is printed electronically by a negative image reproduced on a cathode ray screen. The screen thus provides both the mask and the light source for printing the transparency. The machine can produce 900 transparencies an hour, representing a 20-fold increase in output compared with the older method. This, however, may give a false impression of the improvement obtained because the advantage depends on the average number of duplicates required for each transparency. Thus, in normal production it would still be necessary to change the original colour transparencies frequently, which would reduce the rate of output. Nevertheless the new machine will give a distinct improvement in speed over the older methods and may contribute to reducing the cost of colour duplicates.

Another new machine constructed and being tested in the physics section is a device for rapidly mounting transparencies in frames; it mounts one transparency per second, a rate five times faster than that of the present machine, and should be of great help in meeting peak seasonal demand for transparencies.

Testing

The third and final section of the laboratories is the testing section. It has the double task of helping research by examining experimental materials from the laboratories around them, and of proving actual production methods by examining frequent samples of factory-made materials. It also thoroughly examines the materials produced by competitors.

The equipment here includes sensitometers for exposing film to various kinds of light and conditions, developing machines to give reproducible development conditions and densitometers for measuring the amount of " blackening " produced by the exposures. Colour film is, of course, a very special material, and it undergoes separate and rigorous tests.

(Continued from page 8)

development programme. The chemicals most likely to be used are 2,4-D and 2,4,5-T.

A satisfactory method of eradicating canal weeds is urgently required. The chemicals so far tried, 2,4-D, monuron and NN-dimethylphenylurea have proved to be either ineffective or too expensive. Successful kills of flying swarms of locusts have been achieved by using aerial application of both DNC and BHC. When the Locust Control Section in the Sudan have utilised their present stocks of DNC, they will use only BHC in future aerial spraying.

The majority of pesticides imported into the Sudan are from the United Kingdom. There is only one known firm producing a pesticide locally, and this is merely a formulation process for a 25% DDT emulsion, the DDT concentrate and emulsifier being imported, the former, at the moment, from the U.S. It is used for spraying cotton against leafhoppers (Jassidæ species) and thrips, but since it is liable to break down on storage for even short periods, only sufficient is produced for immediate demands.

Several importers of pesticides are thinking along the lines of local production of various products, but current business would hardly justify the installation of expensive plant. There are no local supplies of suitable containers so far, although it is reported that a firm will shortly start production. The most attractive proposition would appear to be the insecticidal dusts, for which there is a reasonable market at the moment for such purposes as locust baiting, treatment of hides and skins, the andat bug, grain storage and household uses. Most of these dusts contain a relatively small quantity of insecticidal active ingredient, the bulk being filler such as china clay, and it is possible that a reasonable substitute filler could be found in that country without much difficulty, and thus, by importing only the concentrate insecticide and adding the diluent here, a considerable saving could be effected in freight and other charges. Other products such as fungicides, weedkillers, seed dressings, rodenticides, are not used in sufficient quantities as yet to justify local formulation or manufacture.

PERFUMERY and Essential Oils

Citrus oils • Odorous substance in ants • Black pepper oil
Methyl eugenol • Bois de rose oil • Synthetic linalol

By G. B. Pickering, M.A., D.PHIL., A.R.I.C.

U.V. check on citrus oils

IN anticipation of an increase in the use of ultraviolet absorption spectra as a criterion by which quality and purity may be measured, Hendrickson, Kesterson and Edwards[1] at the Citrus Experimental Station, Lake Alfred, Florida, have investigated the absorption curves for cold-pressed Florida orange, tangerine, grapefruit and Persian lime oils, and also for mixtures of these oils and samples adulterated with doubly distilled (+)—limonene.

Representative samples, secured from large commercial lots, and considered to be of excellent quality, as well as conforming to the standards of purity for the particular type of oil, were used for the measurements. The U.V. absorption spectra were measured at a dilution of 0·25 g. of oil in 100 ml. of 95% ethanol using a 1 cm. silica absorption cell, except in the case of Persian lime oil where the absorption was so great that it was necessary to use a 1 mm. cell.

Cold-pressed orange oil. Twenty-two samples of cold-pressed orange oil, each taken from 28,000 lb. lots of commercial oil, were examined. CD values (this is obtained by drawing a line AB tangent to the points of inflection of the curve and dropping a vertical line CD from the point of peak absorption to the line AB[2]) ranged from 0·25 to 0·39 and the peak absorptions occurred at 330mμ with values from 0·42 to 0·68. Samples were taken over the period December to June, during which time the variety of orange being processed changed according to the months of ripening, but the variety of fruit had no influence on the CD values or peak absorptions obtained.

The factor which had previously been found by Kesterson and Hendrickson[3] to influence the physical and chemical properties of the oil to the greatest extent was the yield secured from the peel, consequently the examination of three samples of cold-pressed orange oil all made by the same process, where the only variable was the yield of oil obtained, was of interest. Table I shows that as the yield increased, the values for specific gravity, evaporation residue and refractive index also increased, but the values for optical rotation decreased. The values for CD and peak absorption also increased. Evidently, as the yield of oil is increased, more high boiling, high molecular weight constituents are extracted; the presence of a higher percentage of these compounds in the oil causes a reduction in the percentage of (+)—limonene, resulting in higher CD and peak absorption values.

Cold-pressed tangerine oil. Three lots of cold-pressed Dancy tangerine oil, analysed over a period of three years, showed peak absorption at 325 mμ ranging from 1·05 to 1·28 and at 270 mμ ranging from 1·27 to 1·43. At 325 mμ, CD values ranged from 0·53 to 0·68 and at 270 mμ, from 0·20 to 0·24.

Cold-pressed grapefruit oil. Three lots of commercial cold-pressed Duncan grapefruit oil, collected during two different seasons, showed peak absorptions 319·5 mμ to 320 mμ with values from 0·317 to 0·365; whereas the CD values ranged from 0·252 to 0·290.

Cold-pressed Persian lime oil. Two lots of this oil were analysed and peak absorptions occurred at 320 mμ with values of 1·37 and 1.59 and CD values of 1·09 and 1·23 respectively.

Adulterations and admixtures of cold-pressed citrus oils

It is possible that double distilled limonene derived from citrus may be used as an adulterant for citrus oils when certain price considerations are involved. The effect of adulteration with limonene in the U.V. absorption values of cold-pressed grapefruit oil is shown in Table 2 below.

The admixture or blending of citrus oils of different fruits can also be investigated by U.V. absorption.

The addition of a small amount of orange oil to grapefruit oil depresses the CD and peak absorption values, and shifts the peak from 320 mμ for grapefruit towards 330 mμ, the peak for orange oil.

A California type lemon oil can be converted into an Italian type by the addition of 10% of Persian lime oil. Such samples have been submitted to essential oil houses and they have been judged to be

Table 1.—Relation of Yield to Properties of Cold-pressed Orange Oil

Yield lb. oil/ t/m peel	*Specific gravity* 25°C./25°C.	*Refractive index* n_D^{20}	*Optical rotation* α_D^{25}	*Evaporation residue* %	*CD*	*Peak absorption* (330 mμ)
2·16	0·8430	1·4730	+97·23	2·03	0·27	0·46
3·22	0·8435	1·4732	+97·21	2·39	0·33	0·57
3·50	0·8438	1·4733	+96·50	2·55	0·39	0·68

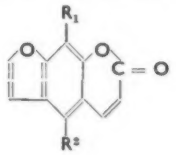
Table 2.—Effect of Limonene Adulteration on U.V. Values

Cold-pressed grapefruit oil %	*(+)-Limonene* %	*CD*	*Peak absorption* (320 mμ)
100	0	0·253	0·322
75	25	0·146	0·195
50	50	0·119	0·165
25	75	0·059	0·090

good quality lemon oil. The U.V. absorption curves give a much greater peak absorption and CD value for the admixture than for pure California lemon oil. Also if the U.V. curve is made very carefully, a shift from 315 mμ to 316-317 mμ may be noted for the peak absorption value, thus indicating adulteration.

Coumarins in cold-pressed lemon oil

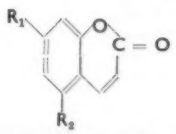
Various coumarin compounds have been reported in citrus oils, *e.g.* 5 : 7-dimethoxycoumarin, 5-methoxypsoralen, 5-hydroxypsoralen and 5-geranoxypsoralen have been isolated from oil of bergamot; 5 : 7 - dimethoxycoumarin, 5 - geranoxy - 7 - methoxycoumarin and 5 : 8-dimethoxypsoralen from lime oil; auraptene from orange oil; and 7-hydroxycoumarin from grapefruit oil. Limettin (5 : 7-dimethoxycoumarin) and another, unidentified, coumarin have previously been reported in lemon oil. A recently published study,[4] which is part of a comprehensive investigation of lemon oil, has led to the isolation of a number of coumarin compounds including limettin.



(I) 5-Geranoxypsoralen
$R_1 = H$, $R_2 = OC_{10}H_{17}$

(V) 8-Geranoxypsoralen
$R_1 = OC_{10}H_{17}$, $R_2 = H$

(VII) Byakangelicin
$R_1 = OCH_2.CH(OH).C(OH)(CH_3)_2$, $R_2 = OCH_3$



(II) 5-Geranoxy-7-methoxycoumarin
$R_1 = OCH_3$, $R_2 = OC_{10}H_{17}$

(VI) 5 : 7-Dimethoxycoumarin
$R_1 = R_2 = OCH_3$

A quantity of cold-pressed lemon oil was absorbed on a column of silicic acid and the column eluted first with hexane, then with increasing concentrations of ethyl acetate in hexane, and finally by a solution of 10% ethanol in ethyl acetate. When all the hydrocarbons had been removed by elution with hexane alone, as shown by testing for unsaturation with chromatostrips (fluorescein-bromine test) the fractions from a collector were tested by development on chromatostrips containing small amounts of luminescent mineral phosphors. The developed strips were examined under U.V. light when compounds which absorbed the radiation appeared as purple shadows on a yellow background. Compounds (II), (IV) and (VI) (substituted coumarins, see below) fluoresced a brilliant blue, and (I), (III), (V) and (VII) (substituted psoralens) appeared as purple spots. Individual fractions from the fraction collector were combined into composites on the basis of their behaviour on the chromatoplates. The composite fractions were stored at 5°., and the products which crystallised were purified by recrystallisation. The total amount of coumarins recovered from lemon oils by this technique averaged 0·38% by weight.

The U.V. spectra in neutral solution and their chemical properties proved that these compounds were, in fact, substituted coumarins. Furthermore, on addition of aluminium chloride and caustic soda to their cold alcoholic solution there was no bathochromic shift in the spectral absorption, showing that the compounds did not contain free phenolic hydroxyl groups. All the compounds isolated gave a negative magnesium-hydrochloric acid test for flavones.

By comparison with specimens from other sources, or the conversion by hydrolysis and re-substitution to known substituted coumarins, the following compounds were identified among the crystalline products: -5-geranoxypsoralen (I), 5 - geranoxy - 7 - methoxycoumarin (II), compound (III) possibly a homologue of (I), compound (IV) - a 5 : 7 dialkoxycoumarin-possibly a lower isoprene homologue of (II), 8-geranoxypsoralen (V), 5 : 7 - dimethoxycoumarin (VI) and byakangelicin a 5 : 8-diether of psoralen (VII).

Dendrolasin, an odorous substance in ants

When the product obtained by extracting the ant, *Lasius* (*Dendrolasius*) *fulginosus* Latr., with light petroleum and evaporating off the solvent is distilled in steam, an oil is obtained, 8-10 kg. of insects yielding 60-70 ml. of oil.[5] By fractionation of this oil under reduced pressure, dendrolasin, $C_{15}H_{22}O$, which constitutes about 75% of the total oil, can be obtained as a colourless oil with a lemon-grass odour, b.p. 148-150°/16 mm., n_D^{20} 1·486, d_4^{20} 0·9108.

This compound is optically inactive, exhibits a neutral character and is not dissolved by dilute alkalies or acids, but it is polymerised by strong mineral acids. It is inactive towards reagents for the carbonyl group and to phenyl isocyanate indicating that it is not an aldehyde, but its colour reactions, capacity to give complexes with mercuric salts and sensitivity to acids indicate a furan compound. Assuming that the compound is a substituted furan, then the empirical formula indicates that two double bonds are present in the side chain.

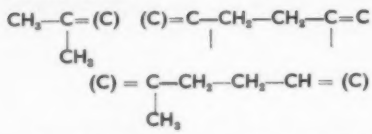
In support of this hypothesis the infra-red spectrum shows no bonds attributable to CO or OH, whereas there are several which can be assigned to a furanoid system (most of these appear to be shifted from the positions they normally occupy in α-substituted furans, however), and two bands at 1,679 and 834 cm.$^{-1}$ which are probably due to aliphatic double bonds of the type —CH=C<.

In the octahydroderivative (perhydrodendrolasin, $C_{15}H_{30}O$) produced by catalytic hydrogenation, the infra-red spectrum is characterised by the total disappearance of the bands belonging to the furan system and the occurrence, at about 1,060 and 910 cm.$^{-1}$, of two broad bands which can be assigned to the saturated tetrahydrofuran ring. The presence at 1,383 cm.$^{-1}$ and 1,364 cm.$^{-1}$ of the isopropyl group bands, associated with the absence of those at 1,679 and 834 cm.$^{-1}$ belonging to the —CH=C< group, indicates that an isopropylidene group >C=C $(CH_3)_2$ is contained in dendrolasin.

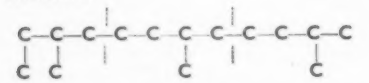
Hydrogenation using a mixed catalyst of Pd/C and Pd/Ba S04 gives tetrahydrodendrolasin in which the furan nucleus is unchanged but the side chain reduced. The infra-red spectrum shows bands due to the furan nucleus and the *iso*propyl group.

On ozonolysis in ethyl acetate solution, dendrolasin gives several products, among them acetone (in the form of its dimeric peroxide), levulinic aldehyde and succinic acid. The formation of these substances indicates that the following struc-

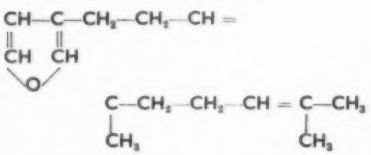
tural units may be present in dendrolasin:



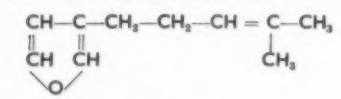
Considering these degradation products in conjunction with the infra-red spectrum, it appears that dendrolasin, while containing a furan nucleus, is also related to the terpenes. It could be formed by union of three isoprene units, one of them oxygenated and involved in the formation of the furan ring. Assuming a head-to-tail linkage of isoprene units, gives a carbon skeleton



or, inserting the atoms to make up the furan nucleus and the known portion of the side chain,

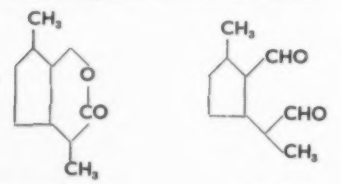


This structure shows considerable resemblance to that of perillene (formed by head-to-tail linkage of two isoprene units), isolated by Japanese workers from the essential oil of *Perilla citriodora* Mak.



Perillene

It is interesting to note that compounds from the various *Iridomymex* species of ants[6] such as *iridomyrmecin* and *iridodial*



Iridomyrmecin

Iridodial

can also be formed by head-to-tail union of two isoprene units.

Confirmation of this structure, β - (4 : 8 - dimethylnona - 3 : 7 - dienyl) furan, assigned to dendrolasin has come from the synthesis of tetrahydrodendrolasin and perhydrodendrolasin which proved to be identical with the corresponding hydroderivatives of natural dendrolasin.[7]

Composition of volatile oil of black pepper

For many years[8] the volatile oil of black pepper, *Piper nigrum*, has been known to contain hydrocarbons such as (-) -α-phellandrene, dipentene, and caryophyllene, but the nature of the small amounts of oxygenated terpenes, which are responsible for the characteristic odour of the oil, was unknown until the recent investigation by Hasselstrom and his colleagues[9] in America.

Malabar black pepper, cured by sun-drying and containing 5·9% fixed oils and 3·2% volatile oils, was ground in a mill together with solid carbon dioxide. The resulting powder was slurried with water and the slurry distilled with steam. The distillate was extracted with ether to take up the volatile oil, and the ether solution washed with dilute aqueous solutions of boric acid and sodium bicarbonate to remove basic and acidic constituents.

The basic fraction of the oil was found to contain piperidine, estimated to constitute 0·1% of the total oil. α-Methylpyrroline, which Pictet identified in black pepper oil, could not be isolated in this study.

The sodium bicarbonate wash yielded phenylacetic after acidification (0·2% of the oil).

The volatile oil recovered by evaporation of the washed ether extract was separated into monoterpenes and higher boiling constituents by vacuum distillation through a Steadman packed column. The monoterpenes were fractionated further through a Naragon-Lewis concentric tube column at atmospheric pressure. The compounds isolated were α-pinene (14%), β-pinene (23%), (−)-α-phellandrene (7%), (±)-limonene (25%).

The higher boiling constituents, consisting of oxygenated compounds and sesquiterpenes, were separated into a hydrocarbon and an oxygenated fraction using chromatography on alumina and eluting the former with petroleum ether and the latter with methanol.

The higher boiling hydrocarbon portion was redistilled at 135 to 145°C./24 mm. β-Caryophyllene, which formed 19% of the oil, was present among the sesquiterpenes and there was a blue residue of azulene. The latter was further purified chromatographically but its absorption spectrum (λ max. 254 and 264 mμ) did not correspond to any of the common azulenes.

A crystalline compound, present in the eluates, was found to be epoxydihydrocaryophyllene, which has also been found in small amounts in steam-distilled clove oil.[10] Incidentally, neither clove oil obtained by solvent extraction[11] nor the oil obtained by low temperature vacuum distillation of black pepper oleo-resin (isolated by benzene extraction), contains caryophyllene, which would appear to be, in these instances, an artifact of steam distillation.

The other oxygenated compounds of the pepper oil, besides caryophyllene oxide, were dihydrocarveol (2% of the original oil), piperonal (0·5%), and cryptone (0·1%) together with traces of mono- and sesquiterpene alcohols. It is considered that these oxygenated compounds are responsible for the characteristic odour of the oil, and the result of this work might be of use if it was ever necessary to formulate an acceptable synthetic pepper (*e.g.*, in a national emergency).

Methyl eugenol from *Anemopsis california*

The distinctive and rather spice-like odour of *Anemopsis california* is due to the volatile oil present in the leaves and rootstock. The latter is the richer source of the oil and the ground rhizomes on steam distillation followed by ether extraction of the distillate were found to give a yield of 8·7%.[12]

The crude oil was fractionated under reduced pressure and a redistilled sample of the fraction b.p. 141° - 146°/23 mm. was found, fortuitously, to give an analysis in very good agreement with the formula $C_{12}H_{16}O_2$. Catalytic hydrogenation indicated a single olefinic bond, and oxidation with potassium permanganate in pyridine produced veratric acid (3 : 4-dimethoxy benzoic acid) which was confirmed by the preparation of veratramide. The ultra-violet absorption spectrum also suggested a veratryl ring with the olefinic bond in a nonconjugated position.

It appeared, therefore, that the compound was veratrole with a butenyl substituent $(C_4H_7)C_6H_3$

$(OCH_3)_2$, and since the hydrogenated product would be a butyl veratrole (actually a 4-butylveratrole since the position of the alkyl group is known from the oxidation), a comparison of the hydrogenated product with the 4-butylveratroles obtained by synthesis was made.

This comparison was facilitated by preparation of the crystalline sulphonamide from the hydrogenated oil. This last compound, however, proved distinct from the sulphonamides of any of the synthetic 4-butylveratroles or of *iso*-amylveratrole. It was, in fact, the sulphonamide of 4-*n*-propylveratrole and the original fraction proved to be 4-allylveratrole (better known as methyl eugenol). The analysis as $C_{12}H_{16}O_2$ (instead of $C_{11}H_{14}O_2$) was fortuitous and due to contamination of the original fraction of the oil with compounds of higher carbon content.

Brazil's bois de rose oil industry

Although bois de rose oil is used as such in the industry, only one-fifth of world production is so employed, the remainder being used for the isolation of linalol (of which the oil contains about 80%). From linalol various derivatives are prepared, in particular linalyl acetate. Bois de rose oil, linalol and linalyl acetate are extensively used in soap perfumery and also in a wide range of toilet preparations.[13]

The Brazilian *Pau Rosa* or rosewood tree (*Aniba rosæodora* var *amazonica Ducke*) grows in clayey soil in Western Para and Amazonas regions, following the courses of the great rivers, but some miles from the banks and well above flood level. Between 1938 and 1951 some 3,000 tons of oil were distilled, corresponding to 350,000 tons of wood or 200,000 trees, but the more accessible reserves are rapidly becoming depleted and few firms attempt replanting. A recently created commission for the economic development of the Amazon basin, assisted technically by the Northern Agronomical Institute, is now seeking to improve conditions in the bois-de-rose industry and may lay out plantations as it is already doing with rubber.

In Amazonas and Para, associations of bois-de-rose oil producers, recognised by State governments, have been organised to assist the industry, to make representations to State and federal authorities, and to fix prices. A joint report by, those associations recently urged the modernisation of the industry, and points out that the oil is distilled in 51 small, precariously equipped distilleries, in which production costs are inflated by avoidable wastage. If the oil is to compete in international markets, processing should be concentrated in four distilleries, situated at Manaus, Itaquatiara, Parintins and Mauses, and the work should be done by a co-operative organisation financed by the Commission for the Economic Development of the Amazon Basin.

The report continues: "Special care must be taken to improve the quality of production. The natural oil can be used to give bouquet to toilet soaps, as it is not decomposed by the alkalies employed. This use is at present limited, however, by the fact that the perfume of the bulk of the oil we export is not sufficiently delicate, as it is distilled under improper conditions, with inadequate pressures and incipient fermentation processes. We estimate that annual sales could be increased by 200 tons if the quality of the oil were improved."

Whether these improvements in the production and quality of the oil will enable it to compete as a source of linalol with the synthetic product will depend very much on price.

Synthetic linalol

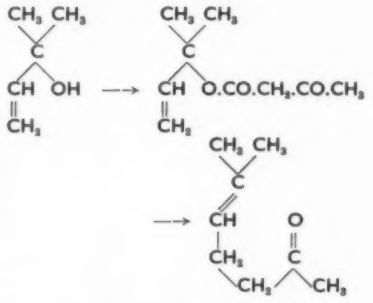
That Hoffmann-La Roche and others have developed a completely synthetic route to vitamin A, which avoids the dependence on citral from lemongrass oil with its wide price fluctuation, has been known for some time, and a recent description of the process[14] is of considerable interest.

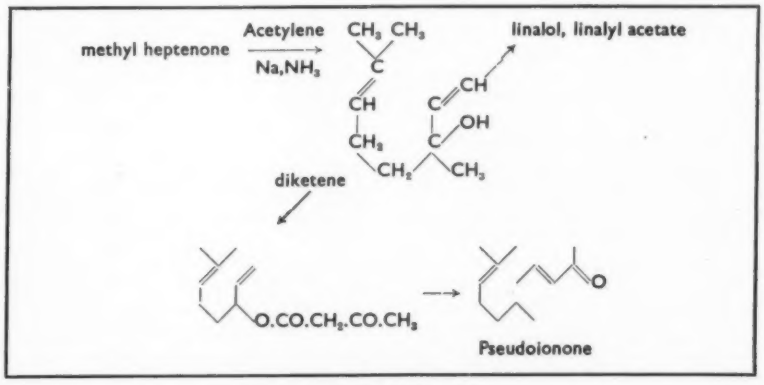
Formerly the Roche process for the manufacture of synthetic vitamin A started with citral from lemongrass oil which was converted into pseudoionone. This was then processed to vitamin A and β-carotene, and to vitamin E which is being used increasingly in animal and poultry feeds.

A process has now been developed for the total synthesis of pseudoionone, and since the route is via dehydrolinalol, branching off at this point gives linalol by partial hydrogenation, or acetylation and partial reduction gives linalyl acetate.

Acetylene, made from carbide, is combined with acetone through the agency of liquid ammonia, to give methyl butinol $CH{\equiv}\ C.C(OH).(CH_3)_2$ and this is partially reduced with the aid of a special catalyst, to methyl butenol or dimethyl vinyl carbinol $CH_2{=}CH.C(OH).(CH_3)_2$.

Diketene is made by the pyrolysis of acetone, followed by condensation, the by-product, methane, being used as a fuel. Reaction of diketene with the dimethyl vinyl carbinol gives the acetoacetic acid ester of this alcohol which when heated to 140°-160°C. loses carbon dioxide and rearranges to methyl heptenone in high yield.





Synthesis of Linalol

Methyl heptenone by reaction with acetylene in the presence of liquid ammonia leads to dehydrolinalol. This may be partially hydrogenated to yield linalol, or it can first be acetylated and then partially reduced to linalyl acetate. Alternatively dehydrolinalol may be treated with diketene and the resulting acetoacetic ester on pyrolysis at 170°-190°C. gives pseudoionone, the yield being 35% based upon acetone and acetylene.

The synthetic linalol and its acetate prepared by this process are claimed to have superior purity and uniformity, with enhanced stability and practically no tendency to discolour.

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Pest Control Chemicals

Fungicides • Miticides • Captan antifungal • Insect attractants and repellents • Mercury and eelworm

By D. P. Hopkins, B.SC., F.R.I.C.

Long Ashton Work

SINCE the last report in this series the Long Ashton Annual Report for 1956 has been published.[1] As usual, it contains a diversity of research items in this field, 17 of the 30 papers being concerned with pest control materials or techniques. Studies of coal tar derivatives for use as fungicides to control rubber-tree mouldy-rot disease have continued.[2] The greatest activity is associated with tar acids, particularly those in the 220°-250°C. boiling-point range. Phytotoxicity has usually handicapped coal tar constituents as plant fungicides; for use on rubber trees, there is no hazard if the mixed phenol concentration is 1% or even more. Long-term trials with captan for apples have ended[3] and the level of scab has been kept very low following post-blossom sprays of captan; however, closely similar results have been obtained with lime-sulphur. Some indications of heavier fruit cropping were given for captan. Captan also kept down lenticel rotting with Allington apples during a four-years' trial, provided two or three sprayings per summer were given.[4] One of the oldest fungicides, Bordeaux mixture, has been successfully used to control leaf spot fungus attacks on the Lactan banana variety which is now much grown in Jamaica, the Gros Michel variety having been steadily discarded since 1945 because of its susceptibility to Banana disease.[5] However, the Lactan variety's vulnerability to attack by leaf spot must be controlled for economic cropping. Effective control was made more certain by including a non-ionic wetter, an alkyl aryl polyether alcohol. It is also reported[6] that factors affecting the deterioration of Burgundy mixture to malachite have been studied, and continuous stirring has been found to retard this. Better methods for preparing Bordeaux mixture have also been investigated. These last two points, though possibly minor, suggest that modern research applied to older pest control substances may well make them more competitive with newer materials.

Copper fungicide deposits

Indeed, directly on this last subject, a Long Ashton contribution has been published elsewhere.[7] Retained deposits on leaf and other surfaces sprayed to beyond the "run-off" point with Bordeaux, Burgundy, and cuprous oxide products have been studied, and in no instance was the level of deposit influenced by the extra spraying. Spray retention was found to be dependent upon two factors—spray concentration and surface wettability, with increased deposit as these influences increased. The intervention of wetting agents was also examined. Some agents—anionic, cationic, or non-ionic—lowered deposit levels, and with highly concentrated sprays the lowering was serious. It is clear that copper fungicide sprays must be formulated with most careful attention to the suitability of any wetting agent used. The addition of viscosity-increasing materials such as glycerol or gelatin did not increase the deposit level of sprays.

New American fungicides

Many trichloromethyl thiosulphonates have been prepared and tested on spores of common fungi.[8] These contain the grouping, RSO_2SCCl_3, not dissimilar to the grouping, $NSCCl_3$, already known to endow good fungicidal properties (*e.g.* captan). As a class the arenethiosulphonates were found to be effectively fungicidal, inhibiting test spore germination with two fungi (*curvularia lunata* and *monilinia fructicola*). *Ortho-* and *para*-substituted derivatives seemed to have about the same fungitoxicities. Aliphatic derivatives, two of which were in the series, had no fungicidal activity. Replacing the trichloromethyl group with an *o*-nitrophenyl group markedly reduced fungitoxicity.

New miticides

At the A.C.S. autumn meeting two new miticide-cum-insecticide products, *Nialate* and *Phostex*, were described.[9] *Nialate* is bis - (S - diethoxyphosphinothioyl) mercaptomethane. It is said to rapidly kill mites and to have good ovicidal and residual activity. At rates likely to be required in commercial use it is non-phytotoxic except to prunes and one variety of apple. It seems

to be non-systemic. Though less effective against aphides, it has promise for certain aphid species, having been effective against some insect pests, *e.g.* codling moth. Phostex is a mixture of bis(dialkoxyphosphinothioyl) disulphides derived from a 3 : 1 mixture of ethanol and propanol. Phostex has promising miticidal activity, but its most likely field is in dormant treatment for the overwintering stages of mites, aphids and scale insects. An interesting claim is that it is the least toxic organo-P pesticide yet made available.

Captan and chocolate spot

British workers (Glaxo Laboratories) have examined the ability of captan to control chocolate spot of broad beans.[10] The systemic nature of captan's antifungal activity seemed to encourage this prospect. When applied only to parts of leaves of test plants captan gave protection to all foliage, confirming the systemic effect; and the protection given was also persistent. Similar but not as powerful protection was given when captan was applied by watering the plant roots; however, any general developments of this application method seem unlikely as captan is phytotoxic to some plants when used in this way. As there is not at present a generally recognised control for chocolate spot, the captan possibility is important. Copper fungicides have to be sprayed with frequency to give much protection and a stage is reached when the size of the growing plants usually makes spraying impossible or difficult.

Citrus red mite control

Resistance by the citrus red mite to the acaricide, Ovex, is reported in some districts of California. Initial tests with 4,4'-dichloro-alpha-(trichloromethyl) benzhydrol or FW-293 carried out in 16 groves showed good control.[11] Other mite species were also controlled to some extent, though not in every case as effectively as by other materials used specifically for these pests, *e.g.* as petroleum oil or Chlorobenzilate for citrus bud mite. However, there was some indication that combinations of FW-293 with Chlorobenzilate were more effective than the latter used alone.

Formulation

A new instrument for measuring a carrier's capacity to adsorb a pesticide and still remain "flowable" has been described.[12] It is a long-stemmed funnel rigidly supported above the centre of a rotating steel disc; the distance between the bottom of the stem and the plate can be adjusted accurately to small gaps such as 0·03 to 0·05 in., though certain carriers need bigger gaps and also an agitating device to stop bridging. There is an abrupt increase in flow time when the maximum adsorptive capacity of the carrier is reached—the sharpness of the breakpoint indicates exactly the pesticide concentration that a formulator should select for trouble-free products. It is claimed that the instrument has given reproducible results that can be well correlated with plant experience.

Repellents and attractants

The important subject of insect repelling or attracting has been given only infrequent attention in these Reports. A comprehensive U.S.D.A. survey of modern development[13] provides a good opportunity to repair this omission. 1942-54 U.S. screening work is summarised. Most good repellents failed in certain usage requirements, mainly for mammalian toxicity weaknesses. The requirements are stringent; a repellent must be non-toxic, non-irritating to skin, non-allergic, fairly non-odorous and non-staining. It should wipe off skin readily and withstand copious perspiration. Repellents for use on clothing should withstand laundering. Preferably, too, repellents should not attack plastics, *e.g.* eyeglass frames, etc. Earlier known repellents, such as dimethyl phthalate, were effective against a limited range of insect pests; wartime developments involved mixtures of these to give the widest possible range of control.

One of the best wartime discoveries seemed to be butyl carbitol acetate, but it was found unsafe and its use stopped. As an anti-mite measure, benzyl benzoate was successfully used in War II and the Korean campaign. The empirical phase of repellent research ended with a statistical study of over 4,000 chemical repellents to ascertain connections between structure and repellency. This revealed that most compounds effective for more than 3 hrs. were amides, alcohols, esters, or, to lesser extent, ethers. The N,N-dialkyl amides were selected as being particularly worthy of study, and several years' research at Beltsville led to diethyltoluamide (N,N - diethyl - *m* - toluamide), the best insect repellent. It repels a wider range of insects that attack man and for a longer time than any other material yet known.

Attractants, used either for surveying insect populations or as baits for toxic materials, differ from repellents in one major property. Whilst the repellent substance exerts its effect only at short distance, attractants exercise their effects at considerable distances. Sex attractants have been derived in minute quantities from female insect bodies in U.S., Germany and Japan; the chemistry of these highly active substances is unknown. However, empirical work has found a variety of chemicals with attractant powers, *e.g.* methyl eugenol for the male oriental fruit fly. Angelica seed oil was found to be a most potent attractant for the Mediterranean fruit fly or Medfly; the annual production of this oil, 600 lb., proved grossly insufficient when it was recently attempted to eradicate Medfly in Florida, but substitutes made by the perfumery trade in 1956-57 proved non-attractant. The chemical nature of the attractant substance in angelica oil is unknown, though it may possibly be a sesquiterpene. Meanwhile, synthetic Medfly attractants have been discovered, the esters of 6 - methyl - 3 - cyclohexene - 1 - carboxylic acid (made by condensation of butadiene and crotonic acid).

Empirical screening work is still the main approach to attractant discovery at Beltsville, but one general point can be made—when one compound is a good attractant, most structurally related substances are also attractant. This suggests that the empirical approach may find attractants more readily than it has developed new insecticides.

The survey-paper referred to has a long list of useful references.

Hg versus potato eelworm

Press reports[14] have indicated that a new approach to potato eelworm control is being developed in Scotland. This involves the placing below soil surface level of a "mercury - impregnated dust." Eighty per cent effective experiments have been reported, with increased yields of up to 2 tons per acre. A prototype machine for

(*Continued on page* 42)

BOOK REVIEWS

Organic Reactions. Vol. 9

Edited by Roger Adam. John Wiley and Chapman and Hall. Pp. viii+468. 96s. net.

THIS work, continuing the excellent precedents of the previous eight volumes, is a series of six monographs on (1) Cleavage of non-enolizable ketones with sodamide (K. E. Hamlin and A. W. Weston); (2) The Gattermann synthesis of aldehydes (W. E. Truce); (3) The Bäyer-Villiger oxidation of aldehydes and ketones (C. H. Hassall); (4) The alkylation of esters and nitriles (A. C. Cope, H. L. Holmes and H. O. House); (5) Reaction of halogens with silver salts of carboxylic acids (C. V. Wilson); (6) The synthesis of β-lactams (J. C. Sheehan and E. J. Corey), and (7) The Pschorr synthesis (D. F. BeTar). Each monograph covers about 30 pages with the exception of the fourth which occupies over 200 pages, of which nearly 160 pages are taken up with a series of tables.

These volumes are reference works; much of the material consists of tables and references and cannot be read through; nevertheless, each section contains an introduction and section dealing with the mechanism of the given reaction which, together with the material on the scope of the reaction, constitute a good and readable account of the subject. The section on the scope of a reaction is of particular value to the practising organic chemist as it gives a good indication, in many cases, of the success which is likely to attend a proposed extension of the reaction to new cases. Such data can only be obtained by sifting and rearranging much original material and we are grateful to the authors of these monographs for the work they have done in making these summaries available.

The production, in exact conformity with previous volumes, is excellent; proof reading has been conscientiously done—the only errors detected by this reviewer were the use of capitals in the adjectives of German titles. A very useful addition to this volume is a collective subject index to the previous volumes.

G. M. DYSON.

"AnalaR" Standards for Laboratory Chemicals

Issued jointly by British Drug Houses Ltd. and Hopkin and Williams. Pp. xvl+397, inc. index.

A NEW edition of this book, the fifth, is very welcome especially after the long interval since the last. It is certain to be put to constant use in many laboratories.

It would be appreciated if the "Tests for Chlorides," "no opalescence," which appears on p. xv, could be included with "Standard Opalescence" on p. 385; it is a nuisance to have them so widely separated. Although careful descriptions are given of most of the new methods used, the Jones reductor is quoted on p. 36 and elsewhere and no description of the apparatus is included.

Diaminoethane tetra-acetic acid is noted on p. 121 instead of its usual name, but both appear in the index; the substance is called EDTA, which does not correspond to the official name, nor appear in the index, on pp. 9, 11, 12, 35, 147, 184, 216 and particularly on p. 382. This is surely inconsistent.

The description of melting-point apparatus on p. xvi refers to liquids; these are not now always used. Not all the standard solutions used are given in the list; in the text these are quoted as *e.g.* $AgNO_3$, but potassium ferrocyanide (p. 368), ammonium acetate (p. 12), potassium iodate (215), are quoted in full.

The authors have apparently had considerable difficulty with systematic nomenclature. There is only one satisfactory procedure: ignore all the old names and use only the new to make people accustomed to using them. The preface refers to ethyl alcohol, the text refers to ethanol, both are in the index. All alternative names are not in the index, *e.g.* chrome alum. It seems odd that sodium bicarbonate is not quoted as an alternative title, yet is quoted in the index. The use of the term "ammonium" is not explained; it is not in B.S.S. 2474, nor is it truly equivalent to "sodium." Page 117 refers to standard ammonia solution, elsewhere it is standard ammonium solution. If *Eriochrome* blue-black is a better indicator (p. 379), why not use it?

These comments are offered contructively. The book should be in every laboratory.

Comprehensive Inorganic Chemistry

Vol. VI—The Alkali Metals, by J. F. Suttle; Hydrogen and its Isotopes, by R. C. Brasted. Van Nostrand, 1957. Pp. 234. 45s.

THIS book marks the half-way point of the publisher's plan for a comprehensive 11-volume reference work on the chemical elements and their inorganic compounds. "Comprehensive" means an extensive and wide-ranging rather than a full treatment.

The idea is to produce a *vade mecum* for the advanced worker, not an encyclopœdia. Emphasis has been placed largely on chemical properties and relationships and their interpretation in terms of theoretical concepts of atomic and molecular structure, the deductions from the periodic system, and the basic ideas relating to electrolytes.

In this volume the alkali metals, whose similarity to each other often obscures definite gradations, are discussed with emphasis on as many of these gradations as possible. The coverage of hydrogen in the second part of the book extends through its properties to electronic behaviour and physiological action, with an up-to-date discussion of deuterium and tritium. Noteworthy is the large number of phase and solubility diagrams of the various compounds of these elements.

The book is well bound and clearly printed.

Plate and Frame Filter Presses

A new range of plate and frame filter presses has been introduced to the British market by Durham Raw Materials Ltd. They are produced by the firm of F. H. Schule G.m.b.H. of Hamburg, in sizes extending from a four-chamber laboratory model in *Plexiglass* to multi-frame presses with electro-hydraulic closing and opening devices.

Any of the models are available from Durham Raw Materials Ltd., who have details and plans.

Moulded PVC Fans

The Sturtevant Engineering Co. Ltd., in conjunction with Acalor (1948) Ltd., have produced a range of moulded PVC fans based on their original *Monogram* series. These fans, designed to meet the growing need for exhausting corrosive fumes, have moulded casings and a fully moulded PVC impeller, which it is said, permits higher operating speeds and efficiencies than can be obtained with fabricated fans of this type.

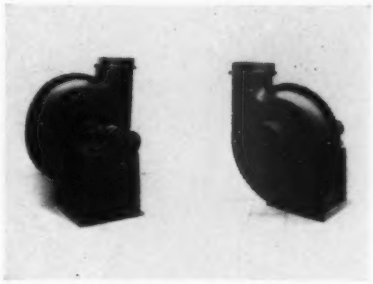
Drive is by means of vee-ropes which enables the most desirable speed to be used and permits the use of motors to suit on-site requirements. Shaft ends are not key-wayed as it is anticipated that taper-lock pulleys will be used.

The capacity of the three smaller fans ranges from 100 to 1,250 Vol. C.F.M. and from 470 to 2,830 Outlet Vol. F.P.M. Fans are supplied either right or left hand rotation and can be assembled from 0 to 180 discharge in steps of 45°.

No. 1 and No. 2 sizes are now available with larger sizes coming forward shortly.

Automatic Incinerator

The problem of disposing of used dressings, towels and other unæsthetic refuse — particularly acute in offices and factories employing women and girls—may be solved simply and efficiently with the Barrywald incinerator. It takes these items and automatically turns them into a small quantity of sterile ashes at a low cost. The incinerator measures only 19 in. × 18 in. × 10 in. and can also be used for document destruction and like tasks.



PVC fans for corrosive duties.

This diaphragm-operated control valve is manufactured by the Crosby Valve and Engineering Co. Ltd.

By depressing a lever at the left of the attractive cream enamelled cabinet the receptacle, fume box and combustion chamber covers are open, at the same time clearing the combustion chamber of the ash remaining from any previous insertion and tilting a mercury vacuum switch. With the incinerator open, the material to be disposed of can easily be placed in the combustion chamber with the other hand.

The operation of the mercury switch turns on the 1 kW. heating element, which is cut out by a time control unit after 5-7 min. The time control unit is reset each time the lever is depressed and full burning time is assured for every article loaded into the incinerator.

A feature of the incinerator is the psychological attitude it creates among the workers. For a private matter of this nature it is obviously desirable to have an appliance which can be worked by the girl herself without the need of an attendant or other spectator. The installation of a Barrywald incinerator, therefore, besides being a step towards better hygiene, heightens the contentment of the younger employee.

Full details may be obtained from the sole distributors, Saniguard Appliances Ltd., London, E.C.2.

For further information

on these items

please use the coupon

on p. 46.

Diaphragm Valve for Small Flows

The Masoneilan type 107/108 diaphragm-operated control valve for exceptionally low capacity applications is manufactured by the Crosby Valve and Engineering Co. Ltd.

This valve, which is particularly useful for pilot-plant and dosing applications, has as standard a 18/8 stainless steel Barstock body rated at 6,000 p.s.i. with ½ in. female connections which can be screwed BSP or API. The body is available with alternative size trims down to the minimum, having a C_v or flow coefficient of 0·07. The trim, which can be supplied in stainless steel or stellite, has a needle type plug giving linear flow characteristics and tight shutoff. The rugged construction of the valve is such that it can be used for pressure drops up to 5,000 p.s.i. The diaphragm superstructure, which is designed for 3-15 p.s.i. air pressure, is of aluminium alloy for lightness and can be supplied to give either reverse or direct action.

The special diaphragm is of nylon-reinforced neoprene. The overall height of this valve is less than 11 in. and weighs 15 lb. With air fin bonnet the weight is 18 lb.

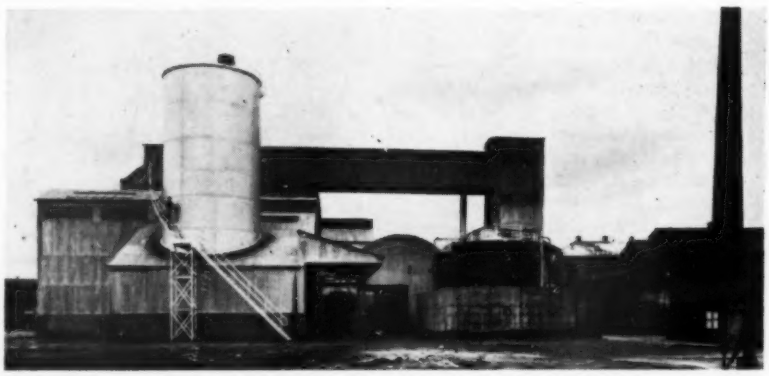
Bigger Plant for Silicates Production

Crosfields Spend £300,000 on New Furnace at Bow Factory

Joseph Crosfield and Sons Ltd., soap and chemical manufacturers, of Warrington, now have the only complete manufacturing unit in the South of England capable of producing silicates as glass or liquor.

This was stated by Dr. J. E. Taylor, Crosfield's chairman, when he announced the coming into production of a large new furnace adjacent to their dissolving and finishing plant at Bow, in East London. The plant was installed in 1938 but the glass, from which was derived most of the company's chemicals, continued to be made at Warrington. Since then, said Dr. Taylor, the demand for silicates in the London area and in Southern England generally had risen by 300%. The state of the market would support the output of a large furnace. Silicate glass would no longer have to be transported from Warrington and this would greatly offset higher freight charges, and it was hoped that by carrying out the complete manufacturing process at Bow they would be able to continue the price stability which they had maintained since 1954.

The new plant built by Joseph Crosfield and Sons Ltd. at their Bow factory for the manufacture of silicate glass. Through the centre run sidings connecting the factory to the main line behind and in the middle of this photograph can be seen sand wagons (right) and a covhop (left). Sand wagons are lifted bodily to discharge their cargo into a drier whilst the covhops unload their soda ash within 10 min. into chutes placed between the lines.



Sodium silicate glass is carried from the furnace and over a bridge by a vibrating conveyor to the dissolvers and evaporators.

Manufacture

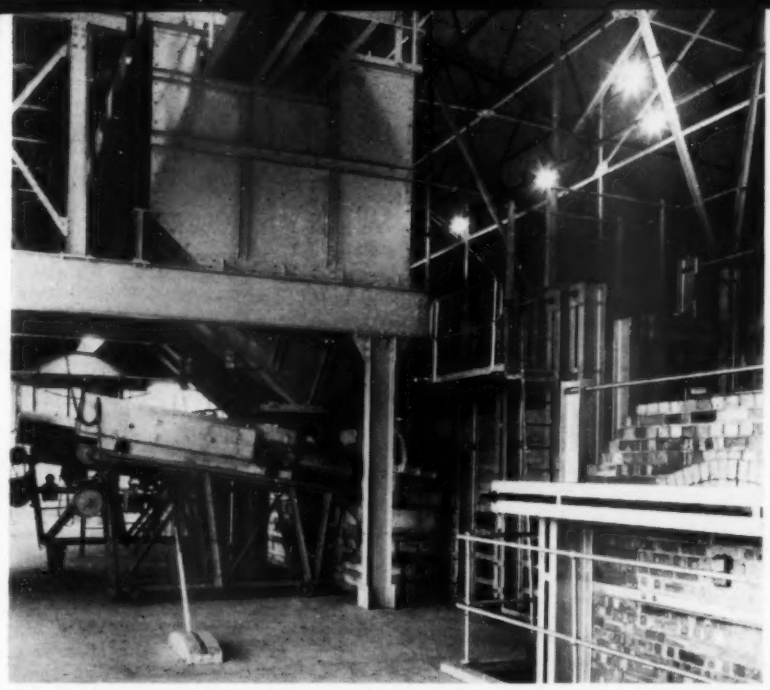
Manufacture of the silicate glass at Bow is almost entirely automatic so that materials handling is minimised. The raw materials, sand and soda ash, are brought in by rail, the sand in 13-ton wagons and the soda ash in covhops each carrying 16 tons.

A wagon tipper lifts the sand wagons bodily discharging their load into a storage hopper. The sand is carried by an elevating conveyor into the sand drier, a rotating cylinder with a centre tube through which the products of combustion from an oil-heated furnace are passed. The sand falls on to the tube and moisture is dried out as it passes through. The dry sand falls into a pit from which it is carried by bucket elevators to an overhead, rubber band conveyor discharging into the sand silo.

The bulk soda ash is passed through a fully automatic, electro-pneumatic system. The covhop rail wagon is drawn into position so that the outlets are immediately above four pneumatically-operated inlet chutes between the lines. The chutes are raised to fit closely round the outlets, the joints being closed by foam rubber washers. When the outlets on the covhop are opened the ash falls into the Fluidor conveyor, consisting of a series of aeration boxes which "fluidise" the ash so that it flows like liquid into a Pneumex pump which blows it by air pressure into the silo or service hopper.

To prevent caking, a second fluidor conveyor draws ash from the silo back into the intake hopper from which it again passes through the pump and is either returned to the silo or blown to the service hopper. In this way the material is kept almost constantly in motion so that is cannot coalesce. Wastage is avoided by passing the exhaust air through a filter which extracts any soda ash which may be present, returning it to the system. The Fluidor conveyor operates at a pressure of 20 in. water gauge and the Pneumex pump at 40 lb. p.s.i.

From the two service hoppers, measured amounts of dry sand and soda ash are fed into two Simon automatic weighers which ensure that the correct proportions of the



The new furnace for the manufacture of silicate glass at the factory at Bow. Sand and soda ash are pre-mixed automatically and conveyed to the hoppers above the furnace; from this they are passed into the chargers in which a worm conveyor feeds them continuously into the furnace. Part of the heat regenerator is seen in the foreground on the right.

materials are passed to the batch mixer. The mixture then travels by a worm conveyor to a bucket elevator which carries it up to hoppers above the furnace; this feed is automatically controlled and the high and low levels of the mixture in the hoppers are indicated by lights. The mixed sand and soda ash falls into the batch feeders, the flow being controlled by valves at the base of the hoppers and the furnace receives the batch by means of the worm conveyor in the batch feeder.

The furnace is oil-fired from either end on a 30 min. cycle and each battery of jets has its attendant regenerator through which the hot gases pass; the regenerators pre-heat air to the jets, giving maximum combustion to the atomised oil and reducing smoke to the minimum. The furnace is maintained at an approximate temperature of 1400°C. to 1500°C. at which the sand and soda ash are fused forming silicate glass. The molten glass pours over a lip opposite to the charging side of the furnace and falls direct into a bucket conveyor. As the glass travels up this elevating conveyor it cools and solidifies. It can then be passed direct to the storage silo, fed on to a vibrating conveyor to which chutes can be fitted at selected points along its length to draw off the glass and direct it through traps to the desired section of the silo, or passed to a second vibrating conveyor which carries it direct to the dissolvers for further processing.

Products

Silicates are sold as lump glass, powdered glass, liquor and soluble powder. In the manufacture of soaps and detergents Crosfields' *Pyramid* brand of sodium and potassium silicates finds particular use because of their good rinsing and anti-corrosive properties. The *Metso* brand sodium metasilicate is a general cleaner of medium alkalinity used as an alkali and soap builder in laundries.

Others, including *Trimetso* and *Solgon*, are designed specially for heavier degreasing and automatic bottlewashing. *Sorbsil* silica gel is a desiccant used to prevent corrosion in goods packed for storage or export. It is also used for chemical processes such as the recovery of organic vapours, gas drying and supporting catalytic agents.

Synclyst and *Nicat* are catalysts, the former being silica-alumina and used in the catalytic cracking of petroleum feed stocks, and the latter nickel, used for the hydrogenation of fats and oils.

It is anticipated that some of the silicate from the new furnace will be exported in glass form. Some export markets, those of Europe and the near East, will be better served from Bow, which has a convenient canal to the Port of London. This should mean speedier deliveries than when all export business was conducted through Liverpool. Larger quantities of silicates will now be available for the company's northern customers and supplies will also be released for experimental work in the development of silicate chemicals. An example of these was calcium silicate, which they launched a few months ago.

The Bow furnace represents an investment of over £300,000, which is indicative of the confidence Crosfields have in the future of silicates. Already a great deal of money has been devoted to expansion projects. The first major capital development was the opening of their silica-alumina catalyst plant at the end of 1951 at a cost of about £1½ million. It is believed to be the first of its kind in the U.K. Work has started on the £5 million rebuilding scheme at the Warrington factory which was announced last year. The first phase of this work is the rehousing of the silicate chemical department, due to be completed in 1960.

2-DEOXY-D-RIBOSE

(*Continued from page 24*)

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News . . .

N.H.S. prescriptions cost £7·6 m. more

According to the report of the Ministry of Health for 1956 the cost of medicines and appliances ordered or supplied by doctors again increased. In January the average cost per prescription was 55·60d., rising in November (the last month before the revised charges were introduced) to 61·52d. The average cost over the year was 59·56d., compared with 53.43d. in 1955. The average annual cost per person on doctors' lists in different parts of the country varied between £2 0s. 4d. and 16s. 2d. Often there were big differences in nearby places. An appendix shows the prescribing costs in each Executive Council area.

Statistics in the Report show doctors the average cost of their prescribing compared with the average for the area in which they practise. During the year 692 doctors were visited by Regional Medical Officers to discuss their prescribing, and 1,324 letters were sent out. Thirteen cases were referred to local medical committees for investigation of prescribing, and in two of them the local medical committee decided that there was excessive cost, but the cases had not been completed by the end of the year. In one case the committee found that no excessive cost had been incurred, and the Minister referred this case to referees. Decisions had not been reached by the end of the year in the other cases.

Prescriptions

The number of prescriptions dispensed by chemists in 1956 was 228,879,170, over 2,700,000 more than in 1955. In some months, particularly the earlier ones, the number was substantially higher than in the corresponding months of the two previous years, although there was no obvious reason for the increase. There was a marked decrease in December when the revised prescription charges were introduced.

The total cost of prescriptions was £56,800,011, compared with £49,120,365 in 1955, and the average cost per prescription was 59.56d. (53·43d. in 1955). One of the main reasons suggested for this increase in the average cost is that cortisone and hydrocortisone, two very expensive preparations, became generally available during the year.

The number of prescriptions for December was 26·02% less than for November and 20·81% less than for December 1955. While the revised charges were no doubt part of the reason for this reduction, sickness was at a lower level than normal during the month. In December the average cost of prescriptions was about 5d. more than in November; estimates based on a sample showed that this was almost entirely due to doctors prescribing larger quantities. This might well be an economy in many cases.

Fluoridation of water supplies which began at Anglesey in 1955 was extended to two other study areas, Andover and Watford. A special Research Committee was set up in the autumn to keep under review research into dental and medical aspects of fluoridation. Final reports of the first fluoridation studies in the United States and Canada and reports of American medical investigations, which became available during the year, provided "convincing evidence of the effectiveness and safety of fluoridation." In the United States it is now accepted as a public health measure and is in operation in 1,487 communities with a total population of over 30,000,000.

B.O.C. are building carbide plant in Ulster

A factory being built by Carbide Industries Ltd. about 4 miles from Londonderry for the manufacture of carbide and acetylene, will eventually employ over 300 people. The factory will be adjacent to a new power station, now under construction by the Northern Ireland Electricity Board, and also to the large site recently purchased by the du Pont Co. (United Kingdom) Ltd.

Most of the carbide produced will be used for the generation of acetylene which will be piped to the du Pont factory for the manufacture of neoprene. Limestone and coke, the main raw materials used in the manufacture of carbide and acetylene, will initially be imported from the United Kingdom. Indigenous limestone may eventually be used.

Plans for the factory include the construction of an import wharf for the delivery of limestone and coke. The wharf will be connected to the main site by an aerial ropeway which is being designed so that it can also be used for the export of carbide in drums.

The plant will include a number of large vertical shaft kilns for the production of lime, each capable of calcining about 150 tons of limestone per day. After crushing and screening, the limestone will be blended with screened dry coke before delivery to the carbide furnace which is being designed as a totally enclosed rotating furnace. The use of this type of furnace will permit the collection of furnace gases which can be utilised after cleaning for firing the lime kilns. This procedure will not only give maximum economy in fuel consumption but will also reduce to a minimum the atmospheric pollution from the furnace.

The company have arranged with the Northern Ireland Electricity Board for the supply of a large block of power from the adjacent new power station.

Carbide Industries Ltd. is a fully owned subsidiary of the British Oxygen Co. Ltd. The factory is being built by British Oxygen Engineering Ltd. Completion of the factory is expected to take about two years.

25-Mile pipe link for Shell factory

Twenty-five miles of underground pipelines linking Stanlow, near Chester, and Partington, near Manchester, has been proposed by the Shell Chemical Co. Ltd., in conjunction with Shell Mex and B.P. Ltd. The plan is subject to a Private Bill which was lodged with Parliament on November 27.

At present the feedstock for the Partington chemical works is shipped in barges via the Manchester Ship Canal. The rapidly expanding demand for petroleum-derived chemicals and the future increase in the productive capacity of the Partington works will, it is thought, be taken care of by this new method of moving feedstock requirements from Stanlow to Partington. Similarly, some of the material produced at Partington may require further treatment at Stanlow and some of the pipelines may be used in this direction.

With the object of concentrating their oil distribution arrangements in this area with maximum efficiency, Shell Mex and B.P. intend to construct a storage depot adjacent to Partington chemical works. The petroleum products required for distribution from this depot will be supplied through Stanlow refinery, and here again it has been found that the most economical and efficient method of bringing the products from Stanlow to Partington will be by pipeline.

The pipelines will all run closely together, will be buried and will not in any way interfere with agricultural or residential amenities.

Instruments factory being built

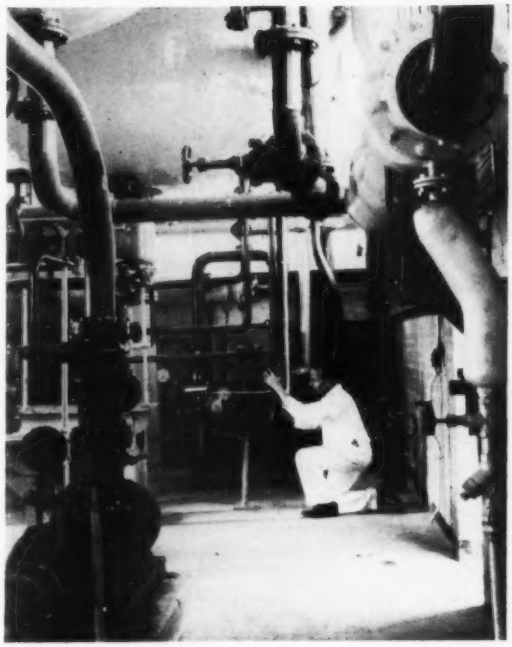
Beckman Instruments Inc. of America are establishing a new factory at Glenrothes in Fife and are already well advanced with its construction. It is hoped to open this new unit in February and to concentrate initial production on a limited number of lines of interest to the control engineering industries.

Synthetic shoe soles

Monsanto Chemicals Ltd. have started up a 4,000 ton p.a. plant at Newport for the manufacture of *Tred* rubber reinforcing resins, used mainly for making shoe soles. The resins are high styrene/butadiene copolymers. Raw materials are styrene obtained from Forth Chemicals, Grangemouth (in which Monsanto have a one-third interest), and butadiene obtained from British Hydrocarbon Chemicals Ltd. The resins are produced by emulsion polymerisation of the monomers to form latices, followed by coagulation, filtering and drying to give *Tred* crumb. The butadiene is brought to the plant as a liquefied gas, carried in road tankers. In the polymerisation vessels it is mixed with styrene, water and a catalyst, the reaction taking place under pressure for some hours. Certain reactions are not taken to completion and unreacted styrene and butadiene are removed in the monomer recovery section for re-use in subsequent polymerisations.

The processes used were devised by Monsanto Chemicals Ltd. and the plant was designed and constructed by the company's engineering department. It is an all-British development.

Similar resins are made in this country by Dunlop and I.C.I.



Polymerisation section of the Tred plant at Newport.

Capsule manufacturers plans

Capsules Ltd., gelatine capsule manufacturers, have had plans approved to build extensions to their factory in Queen Street, Stretford, Manchester.

Max Factor extensions

Max Factor Hollywood and London (Sales) Ltd. are extending their factory at Bournemouth, Hants.

Engineering company's expansion

To meet an expanding market Plenty and Son Ltd. have purchased a new factory site with existing buildings at Shaw, Berkshire, to which will be moved the manufacture of their smaller pumps, filters and impelator mixing machines.

Eagle Iron Works, Newbury, the present head office, will in future concentrate on large pumps and filters, as well as other heavy engineering products for the marine field.

More drugs exempted from tax

The Purchase Tax (No. 2) Order, 1957 (SI 1957: No. 2068) extends the list of essential drugs and medicines exempt from purchase tax under the purchase tax (No. 1) order, 1957, which is revoked. All drugs and medicines previously exempt under the revoked order remain exempt under the new order.

Copies of the Order are obtainable from H.M.S.O., Kingsway, London, W.C.2, and branches, or through any bookseller, price 6d. net, by post 8d.

Fisons remodelled Bramford plant

Fisons Bramford horticultural fertiliser plant near Ipswich, remodelled at a cost of £265,000, is now in production. The plant is now reported to be the largest and most up-to-date of its kind in Britain.

Mechanical equipment designed by the firm's own staff has been installed to speed up production and packaging of their wide range of horticultural fertilisers, weedkillers and insecticides. An administration block, staff canteen and laboratory are to be added in 1958—the centenary of the factory built on the site by Joseph Fison.

Glaxo's polio vaccine unit extended

Two extensions to Glaxo Laboratories' Poliomyelitis Vaccine Production Unit at Sefton Park, Stoke Poges, Bucks, are now working. It is hoped that the extra plant capacity will raise the production of Polivirin, the Glaxo vaccine, by 50% by early summer.

The extensions, which comprise a safety testing suite and a second animal house, were completed at a cost of £150,000. All safety testing of the vaccine takes place here as well as other processes not involving live polio virus.

The larger building, the safety testing suite, has a staff of 40. In this suite work on " non-virus " procedures is carried out—preparation of the synthetic medium on which the tissue cultures are propagated, preparation and maintenance of the tissue cultures, safety-testing the single strain vaccine pools, and the final trivalent vaccine. The vaccine safety-testing suites are equipped with steel operating cabinets which are steamed between operations to ensure that procedures are carried out under conditions of absolute sterility. Windows are fitted with an aluminium surround, making a complete seal. The laboratory sections of both buildings are air-conditioned.

The animal house is designed on the same principles for safety-testing of the vaccine *in vivo* under sterile conditions. The laboratory areas of this building are equipped for the safety-testing and potency testing of the vaccine in monkeys, and also for the supply of kidney tissue to the production unit. All animals are " conditioned " for a period of two to three weeks before use to ensure that only healthy specimens are used for testing purposes.

The animal house is staffed by three technicians and six animal attendants.

Smaller bergamot crop

Owing to the new crop of bergamot oil being considerably reduced, the Consortium have taken immediate steps to avoid any speculation in this commodity so as to protect the interests of consumers. A quota system has been decided upon, and quotas will be based on the average of yearly deliveries to buyers for the two years from September 1, 1955, to August 31, 1957.

Distillation equipment—addendum

The fractionating columns used at the Research Station of the British Petroleum Ltd. which were referred to in our November issue, p. 509, were made by Glass Developments Ltd. We apologise for this omission.

£65,000 extension to Genatosan factory

Two extensions, costing £65,000, to the Genatosan factory were opened recently by the Mayor of Loughborough and Sir Clavering Fison, chairman of the Fisons Group of Companies, owners of Genatosan.

The new buildings consist principally of a welfare block and offices and include a cafeteria which accommodates 120 people at a sitting, a recreation room equipped with television and radio, showerbaths, a surgery and rest room.

A courtyard garden forms a pleasant setting for the cafeteria.

The welfare block stands to the left of the new power-operated main gate in Regent Street. The cafeteria is on the upper floor of this block where all rooms, the recreation room, the executives' dining room, and the cafeteria itself, are finished to the same high standard. The partition walls in the cafeteria can be folded to provide easy access to the recreation room when used as a "sitting out" room for dances and works parties. The floor and doors are of mahogany and beechwood panelling covers one wall.

Genatosan Ltd. was established in 1917 and became a member of the Fisons Group in 1937. The company is in a very active stage of development. Five new products have been launched in the past three months: *Instoms*, *Seb*, *Pulvogen* and two hydrocortisone products have been added to the dermatological range.

Plant makers entertain Canadians

A large number of members attended the reception given by the British Chemical Plant Manufacturers Association and Food Machinery Association at Grosvenor House, London, on December 12 to members of the Canadian Trade Mission interested in chemical plant, food machinery and allied equipment.

The following members of the Mission were present:

J. Arthur Clark (president, Maritime Asphalt Products Ltd.), Kenneth F. Fraser (vice-president, B.C. Packers Ltd.), R. W. Ganong (vice-president and manager, Ganong Bros. Ltd.), Trevor F. Moore (vice-president, Imperial Oil Ltd.), F. M. A. Noblet (vice-president, International Nickel Co. Ltd.), E. J. Wain (general purchasing agent, Canadian Industries).

Isotopes course

A course of eight lectures on radioactive isotopes in pharmacy will be held in the Physics Lecture Theatre of Brighton Technical College from January 16 to March 6, 1958.

The fee for the whole course is £1, or for one part only, 10s. Application forms can be obtained from Dr. J. C. Parkinson, School of Pharmacy, Brighton Technical College, Brighton 7.

Genatosan's new building at Loughborough.

A. and W. subsidiary's expansion

Dr. David E. Jones, president of the Electric Reduction Co. of Canada Ltd. —Canada's producers of phosphorus chemicals—visited London last month to discuss further expansion plans with the parent company, Albright and Wilson Ltd. Electric Reduction has plants in Buckingham, Varennes, Vancouver, and branches in Toronto and Montreal.

Recently, the company announced that it was embarking on a number of expansion projects. Work is in progress on a multi-million dollar expansion of its sodium chlorate plant at Buckingham, Quebec. A large plant for sodium chlorate production was completed early this year in Vancouver to serve the paper pulp industry of the West.

Roussel (Canada) Ltd.

A Canadian subsidiary of the Roussel Laboratories Ltd. was recently opened by Monsieur J. C. Roussel, head of the parent French company, when he headed a three-man delegation to Montreal and Ottawa. With him were Mr. J. Machizaud and Dr. A. Gremeaux, managing director and technical director respectively of Roussel Laboratories in London.

During the three-day visit M. Roussel appeared in a television programme in which he spoke about the pharmaceutical industry in this country.

Gallenkamp in Canada

Two recent exhibitions in Canada were attended by A. Gallenkamp and Co. Ltd. at the invitation of their exclusive agents, Canadian Laboratory Supplies Ltd. A representative range of scientific apparatus, instruments and glassware was shipped for the Canlab show arranged for two days each in Toronto and Montreal. Mr. A. W. A. Rundle, managing director, and Mr. G. F. Adams, technical director, flew out to be in attendance and to set up the stands.

Fluorine in foods

A revised report presented to the Food Standards Committee by its Metallic Contamination Sub-Committee on the fluorine content of foods recommends that the Fluorine in Food Order, 1947, should be amended to set the following limits for the fluorine content of acidic phosphates used for food purposes and of foods containing acidic phosphates:

Articles of food	*Max. fluorine content*
(i) Acidic phosphates	30 p.p.m.
(ii) Any article of food (not included in items (iii) and (iv) below) containing acidic phosphates and intended for use in the composition or preparation of food	30 p.p.m. of the acidic phosphates present.
(iii) Baking powder, including golden raising powder	15 p.p.m.
(iv) Self-raising flour or any similar mixture (not included in item (iii) above) containing a farinaceous substance and an acidic phosphate	3 p.p.m.

The report will now be considered by the Ministers concerned. Anyone with views on the revised recommendations which they would like considered before any decisions are taken should address them to the Assistant Secretary, Food Standards and Hygiene Division, Ministry of Agriculture, Fisheries and Food, Great Westminster House, Horseferry Road, London, S.W.1, to reach him not later than January 31, 1958.

People

Dr. R. Holroyd, deputy chairman of Imperial Chemical Industries, has been appointed Castner Medallist for 1958. It will be presented to him early next year when he is to deliver the Castner Lecture on some aspect of the petrochemical industry.

Dr. I. W. Wark, chief of the Division of Industrial Chemistry of the Commonwealth Scientific and Industrial Research Organisation, has been elected president of the Royal Australian Chemical Institute. Dr. Wark has been in his post since the division was formed in 1940, and under his guidance the laboratory has grown until it now has a research staff of 100.

Col. H. F. Kemball, T.D., D.L., who has been actively associated with Kemball Bishop and Co. Ltd., since 1905, has resigned his appointment as managing director. He was appointed joint managing director to the company on January 1, 1913, and since 1948 has been the sole managing director. Col. Kemball will retain his seat on the board and continue as its deputy chairman. **Mr. R. F. Kemball,** T.D., B.A., and **Mr. W. W. Muir** have been appointed as joint managing directors as from January 1, 1958.

Mr. Kenneth Wilson, O.B.E., having reached the age of 72, has decided to retire from the board of Albright and Wilson Ltd. on January 22. This will be the fiftieth anniversary of the date he joined the company. He became a director in 1910 and has been chairman since 1932. In appreciation of his long and devoted service to the company, the directors have invited him to accept the honorary title of President of the Company and he has agreed. He will continue to be available for consultation. In the 25 years of his chairmanship, the assets of the Albright and Wilson group have increased from £1½m. to £25m. Mr. Wilson will be succeeded as chairman of the company by **Mr. Sydney Barratt** (59) who joined the company in 1932 as assistant director of research. In 1953 Mr. Barratt became finance director and in 1955 was appointed managing director. Last year, when the manufacturing assets of Albright and Wilson Ltd. were transferred to a wholly-owned subsidiary company, Mr. Barrett became chairman of the new company, Albright and Wilson (Mfg.) Ltd., while remaining managing director of the parent company.

Mr. W. G. Freeman has left England to take up an appointment as manager of the newly-formed branch of Evans Medical (Nigeria) Ltd., at Aba, Eastern Nigeria.

Mr. Sydney Barratt.

After 36 years with Borax Consolidated Ltd., **Mr. A. J. Somers,** F.R.I.C., has retired. Since February 1946 he had been on the board of the parent company, now Borax (Holdings) Ltd.

Originally engaged as a scientist, Mr. Somers spent many years between the wars investigating and promoting the industrial uses of borates. He became sales manager in 1940.

Mr. John J. Yorwerth, formerly public relations officer of Benger Laboratories Ltd., has been appointed sales manager. He will be responsible to the marketing controller for the co-ordination of the company's advertising, public relations and sales force activities.

Mr. N. C. Collins.

Sir Henry J. Ross, chairman of the Distillers Co. Ltd. since 1947, will relinquish his executive duties on March 31, 1958, on reaching retiral age. For health reasons, he has also decided to retire from the chairmanship on that date but he will remain a director. In recognition of his distinguished service, the board have appointed him Life President.

Sir Graham Hayman, chairman of the Management Committee, will succeed Sir Henry as chairman of the company on April 1, 1958 and on the same date **Mr. William Reid** will succeed Sir Graham Hayman as chairman of the Management Committee.

Mr. F. Marzillier, vice-chairman and co-founder of Marchon Products Ltd. and Solway Chemicals Ltd., has for personal reasons moved from Cumberland to the south of England. He has resigned his full-time executive directorship in the two companies, but he will retain his seat on both boards in an advisory capacity.

Expanding interest in the East African market has led the Wellcome Foundation Ltd. to appoint **Mr. N. C. Collins,** M.P.S., general sales manager of the company's Veterinary Division, to a new post as manager of Burroughs Wellcome and Co. (East Africa). Mr. Collins, who will work in Nairobi, will have special responsibilities to direct the promotion and sales development of the company's medical and veterinary products. He joined the company in 1940 to set up a sales division for veterinary products.

Mr. W. H. Apthorpe, managing director of the Cambridge Instrument Co. Ltd., has retired from executive duties. He will retain his seat on the board, and will continue to be available for special duties as deputy chairman. He is succeeded by **Mr. H. C. Pritchard** who at present holds a senior position with Elliott Bros.

I.C.I. project receives Minister's approval

The Minister of Housing and Local Government has approved the planning permission granted by the Gloucester County Council at the end of October to Imperial Chemical Industries Ltd. for them to develop a 1,000-acre site on Severnside in the Thornbury Rural District (see MANUFACTURING CHEMIST, July, p. 346).

This project is for the manufacture of organic and inorganic chemicals. The estimated total amount to be invested by I.C.I. by the mid-1970s will be of the order of £100 million.

MEETINGS

Society of Cosmetic Chemists

February 17. "Perfumery," by W. C. Botfield. 7.30 p.m., Royal Society of Arts, John Adam Street, London, W.C.2.

Royal Society of Arts

February 26. (Fernhurst lecture.) "Gibberellic Acid," by P. W. Brian. 2.30 p.m., John Adam Street, London, W.C.2.

Fertiliser Society

January 30. "The Absorption of Nutrients by Plants," by E. C. Humphries. 2.30 p.m. Lecture hall of the Geological Society, Burlington House, Piccadilly, London, W.1.

Institution of Chemical Engineers

January 21. *North-Western Branch.* "Production of Boron-10 by Distillation of Boron Trifluoride," by P. Netley. 7 p.m. Blossoms Hotel, Chester.

Society for Analytical Chemistry

February 13. *Midland Section.* "Nuclear Magnetic Resonance," by Dr. D. H. Whiffen. 6.30 p.m. Birmingham.

Chemical Society

January 17. *Birmingham Section.* "Modern Inorganic Stereochemistry," by Prof. R. S. Nyholm. 4.30 p.m. Chemistry Dept., The University. Joint meeting with the Birmingham University Chemical Society.

January 20. *Cambridge Section.* "A Topic in Conformational Analysis," by Prof. R. C. Cookson, 5 p.m. University Chemical Laboratory, Lensfield Road, Cambridge.

January 23. *Aberdeen Section.* "Some New Chemical Instruments Developed at Harwell," by Dr. R. Spence. 7.30 p.m. Marischal College. Joint meeting with the Royal Institute of Chemistry and the Society of Chemical Industry.

January 23. *Bristol Section.* "Chemistry and Plant Nutrition," by Dr. C. Bould. 6.30 p.m., Chemistry Dept., The University. Joint meeting with the Royal Institute of Chemistry and the Society of Chemical Industry.

January 23. *Sheffield Section.* "Chemical Biography," by Mr. G. Mackay. 7 p.m., Chemistry Lecture Theatre, The University. Joint meeting with the Royal Institute of Chemistry.

January 24. *St. Andrews and Dundee Section.* "Nature and Reactivity of Adsorbed Radicals in Heterogeneous Catalysts," by Prof. A. Kemball. 5.15 p.m. Chemistry Dept., St. Salvator's College, St. Andrews.

January 27. *Newcastle and Durham Section.* "Reduction by Metal-Ammonia Solutions," by Prof. A. J. Birch. 5.15 p.m., West Building, Science Laboratories, Durham. Joint meeting with the Durham Colleges Chemical Society.

January 28. *Edinburgh Section.* "Recent Developments in Polymer Science," by Prof. G. Gee. 7.30 p.m., Biochemistry Lecture Theatre, Teviot Place, Edinburgh. Joint meeting with the Royal Institute of Chemistry, the Society of Chemical Industry, and Edinburgh University Chemical Society.

January 30. *Liverpool Section.* "The Synthesis of Natural Products employing Acetylenic Compounds," by Prof. R. A. Raphael. 5 p.m., Chemistry Lecture Theatre of the University. Joint meeting with the University Chemical Society.

January 31. *Birmingham Section.* "The Chemistry of Tannins," by Prof. R. D. Haworth. 4.30 p.m., Chemistry Dept., The University. Joint meeting with the Royal Institute of Chemistry and the Society of Chemical Industry.

Royal Institute of Chemistry

January 20. *Sheffield Section.* "Petroleum Chemicals," by S. F. Birch. 7 p.m. for 7.30 p.m. Technical College, Queensway, Ponders End, Enfield.

Society of Chemical Industry

January 22. *Food Group.* "The Chemistry of Tea Manufacture," by E. A. H. Roberts. 6.15 p.m. 14 Belgrave Square, London, S.W.1.

February 3. *London Section.* "Microbiological Production of Organic Chemicals," by J. J. H. Hastings, 6.30 p.m. 14 Belgrave Square, London, S.W.1. Joint meeting with the Microbiological Group.

Technical Press Review—January

Atomics.—Metallurgical Development and Atomic Energy; Metallurgical Research; Mass Transfer; The Blind River Uranium Field of Canada; Rolling Mills for Fuel Elements; Microscopes for the Atomic Age; Microhardness Testing; Steel at Berkeley.

Petroleum.—Review of Refining in Great Britain; Steels for the Petroleum Industry; Construction at Fawley Refinery.

Corrosion Technology. — Special issue on Pipelines; High Temperature Hydrogen Sulphide Corrosion in Commercial Sovaformer Units; Humidity and Temperature Test Cabinets; Polyvinyl Chloride Tape in Corrosion Mitigation Programmes; Corrosion of Type Metal; The Protection of Steel Structures in Salt Atmospheres; Underground Corrosion—1, Corrosion Mechanism of Metals in Soil.

Fibres.—Special issue on Textile Chemistry; Textile Chemistry—Some American Developments; Synthetic Resins in the Processing of Textiles; Chemicals in the Manufacture of Synthetic Fibres; Fabrics containing Cotton-type Terylene Polyester Fibre: Man-made Fibres in Carpets.

World Crops.—Forestry; Review of machinery and Equipment exhibited at the Smithfield Show; Insect Enemies of Tropical Timber; The Teak Forests of Northern Thailand; Afforestation of the Swamplands of Finland.

Paint Manufacture. — Wetting Agents in Paints; Mica in Emulsion Paints; Styrenated Alkyds; Waxes in Relation to Carbon Paper Inks.

Dairy Engineering.—Special issue on New Forms of Milk; Liquid Milk in many Forms; Yogurt; "Vitamised" Milks; Slot Machines for Higher Milk Sales; More Milk Powder for Less Labour; Continental Experiences with Milk Cartons.

Food Manufacture.—Annual reviews: Confectionery, Brewing, Pickles and Sauces; Packaging Progress, Evolution of Container Closures.

PEST CONTROL CHEMICALS

(*Continued from page* 33)

incorporating the material into the soil is said to be in production. The cost per acre is spoken of as about £2 2s. as compared with £18 an acre for vaporising eelworm control substances.

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13. S. A. Hall, N. Green and M. Beroza, *J. Agric. and Food Chem.*, 1957, **5**, 663.
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News from Abroad

FRANCE

Stalinon inventor imprisoned

Georges Feuillet, the pharmacist and inventor of Stalinon (see "M.C." December, p. 577) was condemned on December 19 to two years imprisonment and a million francs fine. The Laboratory director, Henri Genet, was fined 100,000 francs. Feuillet's punishment is the maximum that a French court can give in such a case. The official report frequently refers to his "negligence" and "inadmissible imprudence" in failing to examine raw materials and check finished products. The report does not blame the Visa Committee of the Ministry of Health which gave a permit for the sale of Stalinon: on the contrary, it accuses the defendant of having taken advantage of the visa to exploit a product he knew to be unsafe.

Victims still alive and next-of-kin of the deceased were awarded damages amounting to 645 million francs.

ITALY

Drug exports increase

Italian exports of chemical products, excluding refined oil products, during the first half of 1957, were valued at 48·8 milliard lire against 43·5 milliard from January to June 1956 and 38·8 milliard during the same period in 1955. This expansion is accounted for mainly by an increase in exports of pharmaceuticals and chemical fertilisers.

PANAMA

Edible oils development

The Council has approved the development contracts signed by Industria Panama-Boston S.A., for the production of edible oils. It is reported that three more firms, one in Colon and two in Panama City, are negotiating contracts with the Government for the production of soaps and edible oils. Total investment in these three factories is estimated at U.S. $1·5 million. The Panamanian Oil Co. which produces edible oils from coconuts has been unable to maintain its production, however, because of difficulties over the supply of copra from the San Blas Indians.

VENEZUELA

High cost of medicines

There has been much criticism of the high cost of medicines and the Ministry of Development is studying the situation. Formation of a State-owned concern to produce lower-priced goods for Government and other use has been suggested.

AUSTRALIA

Fertiliser output

Latest official statistics show that Australia's output of chemical fertilisers, for the first six months of 1957, included: 2,125,803 tons superphosphate; 425,877 tons mixed chemical fertilisers, including complete manures; 44,781 tons blood, bone and offal manures; 2,640 tons other manures without added chemical fertilisers; and 75,321 tons sulphate of ammonia. Fertiliser works manufactured 549,305 tons sulphuric acid for their own use and 347,167 tons for sale.

Petro-chemicals production

There are now seven refineries in Australia capable of supplying petroleum chemical raw materials. But the scale of production of petro-chemicals is limited by the size of the home market. For the majority of the chemicals this is too small in relation to the high capital cost of plant construction, for with this written off over a relatively small production volume the economic selling price of the products would be too high in relation to the world market.

Import policy under fire

The Australian Department of Trade may be applying import restrictions deliberately as additional protection over and above that afforded by the tariff for the benefit of local manufacturers. This is stated in the annual report of the Australian Association of British Manufacturers. "This is a widespread belief held by importers denied access to the types of merchandise they want from abroad by import restrictions," the report adds. "This view may be unfair to the department . . . but so long as there is a need to restrict imports at all, it is impossible to avoid giving incidental protection to some local industries."

CEYLON

Fertiliser project

Ceylon's Co-operative Wholesale Establishment is to establish a factory for the manufacture of artificial manure at a cost of between Rs.15 million and Rs.20 million. It is hoped that the products will be marketed for at least Rs.20 less than the present average fertiliser price of Rs.330 per ton. World-wide tenders will be invited for the supply of raw materials and the chairman of the Co-operative Wholesale Establishment has stated that attractive offers have already been received from Russia and Japan.

COLOMBIA

Soda ash production

The Bank of the Republic is reported to be considering an investment of Ps. 13 millions in a factory for producing soda ash. The bank runs the salt mines at Zipaquira near Bogota.

Soap and glycerine

Daniel Lemaitre & Cia. Ltda. have opened plants for making soap by a continuous process and a factory for producing glycerin.

ISRAEL

Potash pipeline from Dead Sea

A detailed survey by a foreign engineering firm has been ordered on the feasibility of laying a pipe for potash-saturated water from the Dead Sea to the Mediterranean to carry concentrated solution of the Dead Sea waters. This would make it possible to produce about 500,000 tons of potash yearly in addition to the production at the Sodom potash works. An American group of investors may share in financing the survey. This survey would require more than $250,000, would take over a year to complete and would include market research, technical research on the laying of the pipe, and hydrological research at the Dead Sea. If the survey reveals that the project is feasible, the second stage will be a series of semi-industrial experiments in extracting potash from the solution from the Dead Sea.

THE CHEMICAL MARKET

PHTHALATES DROP SHARPLY. FINE CHEMICALS CHEAPER

LONDON.—The price of **phthalates** has dropped sharply to £187 per ton for diethyl and £179 per ton for dimethyl. **Thiamine hydrochloride** has also declined and now costs £15 3s. 6d. per kg. for 1 kg. lots. **Calcium glycerophosphate, mercuric chloride** and **iodoform** are all cheaper by a few shillings per kg. Reductions of a few pence are recorded for **caffeine, calamine, ferri ammonium citrate, B.P., glycine, procaine hydrochloride, riboflavin, mercurous chloride,** and **potassium bromide. Calcium chloride** has risen by £1 per ton. **Magnesium chloride** is now 10s. per ton dearer. **Calcium lactate, benzoic acid, ether, hydroquinone,** and **glycerophosphoric acid** are increased by a few pence. In the oils and fats section, **palm kernel oil,** now available in 2-ton lots, is increased by £10 per ton, while **palm oil,** also available in 2-ton lots, has been reduced by £4 ton. Gums and waxes continue their fluctuations.

FINE CHEMICALS

Acetanilide
12½ kg. 7s. 2d. kg.
Arsenious oxide B.P.
7-lb. lots 1s. 9d. lb.
1 cwt. lots 1s. 2d. lb.
Ascorbic acid
100 kg. £4 14s. kg.
Aspirin
28 lb. 5s. 8½d. lb.
1-cwt. 4s. 11d. „
5-cwt. lots 4s. 9d. „
Atropine
Sulphate, 500 g. & over £36 2s. kg.
Alkaloid, 500 g. £44 19s.
Benzene B.P.C. 28-lb. lots 1s. 8d. lb.
Benzoic acid 12½ kg. 7s. 4d. kg.
Benzyl benzoate
According to pack 5s. to 5s. 6d. lb.
Bismuth oxide B.P.C. 1934
28-lb. lots 26s. 10d. lb.
Bismuth salts
28-lb. lots:
Carbonate 22s. 3d. lb.
Subgallate 21s. 1d. „
Salicylate 21s. 9d. „
Subnitrate 20s. 5d. „
Borax B.P.
Powder £56 10s. ton
Extra fine £57 10s. „
Boric acid B.P. (Hessian bags)
Crystal £94 ton
Powder £91 „
Bromine B.P.C.
7-lb. lots 6s. lb.
Caffeine 50 kg. 42s. kg.
Calamine 50 kg. 4s. kg.
Calcium gluconate
50 kg. 9s. 6d. kg.
Calcium glycerophosphate
50 kg. 22s. kg.
Calcium lactate B.P.
7-lb. lots 3s. 6d. lb.
1-cwt. lots 2s. 11d. „
Chloral hydrate 50 kg. 10s. kg.
Citric acid, B.P.
Powder or granulated:
1-cwt. lots £11 5s. cwt.
5-cwt. lots £11 „
Codeine
Alkaloid 100 g. £103 3s. kg.
Phosphate 100 g. £80 „
Ephedrine 500 g. lots
Hydrochloride 3 kg. £6 12s. 3d. kg.
Alkaloid 3 kg. £12 7s. kg.
Sulphate 3 kg. £6 12s. 3d. „
Eucalyptol
1-cwt. lots 12s. 6d. lb.
5-cwt. lots 12s. „
Ferri ammonium citrate B.P.
1-cwt. lots, scales 4s. 8d. lb.
1-cwt. lots, granules 3s. 11d. „
Gallic acid B.P.C.
1-cwt lots 9s. 8d. „
Glycerophosphoric acid
24 litres 11s. 10d. litre
Glycine (amino acetic acid)
12½ kg. 22s. 4d. kg.
Hexyl resorcinol 10 kg. £7 15s. kg.
Hydroquinone 12½ kg. 22s. 6d. kg.
Iodides
Ethyl
1-lb. lots 29s. 6d. lb.
7-lb. lots 28s. 6d. „
Mercury, red B.P.C.
28-lb. lots 27s. „
1-cwt. lots 26s. „
Potassium B.P.
28-lb. lots 9s. „
1-cwt. lots 8s. 6d. „
Sodium B.P.
28-lb. lots 14s. 1d. „
1-cwt. lots 13s. 2d. „
Iodine, Chilean crude,
99% min. in wooden casks 17s. 4d. kg.
Iodoform
12½ kg. and under 50 kg. 44s. 6d. kg.
Lactose 50 kg. 3s. 4d. kg.
Lithium salts 5-cwt. lots
Benzoate 11s. lb.
Carbonate B.P.C. 11s. 3d. „
Chloride (commercial) powder 11s. „
„ granular 10s. 9d. „
Hydroxide 9s. 9d. „
Citrate B.P.C. 9s. „
Sulphate 8s. 6d. „
Salicylate, 10 cwt., dlvd. 9s. 9d. „
Magnesium carbonate B.P.
Light. cwt. lots dlvd. £129 ton
Magnesium trisilicate 28-lb. packages
28-lb. lots 4s. 3d. lb.
1-cwt. lots 3s. 10d. „
5-cwt. lots 3s. 7d. „
Bulk rates for larger quantities are from 3s. 1d. lb.
Manganese hypophosphite B.P.C.
7-lb. lots 13s. 11d. lb.
1-cwt. lots 12s. 11d. „
Mercuric chloride B.P.
50-kg. lump 48s. 6d. kg.
Methyl salicylate 1-cwt. lots 3s. 3d. lb.
Morphine
Alkaloid, 100 g. £106 14s. kg.
Nicotinamide 1 kg. £4 10s. kg.
Nicotinic acid
12½ kg. 52s. 6d. kg.
1 kg. 55s. „
Oleine, B.P. extra pale, 3/4 cwt. drums returnable £170 ton
Phenolphthalein 50 kg. 24s. 3d. kg.
Phosphoric acid B.P.
(s.g. 1·750) 10 carboy lots 1s. 4d. lb.
Potassium permanganate B.P.
1-cwt. lots dlvd. 1s. 11½d. lb.
Procaine hydrochloride (foreign) 2 kg. 59s. 6d. kg.
Quinine 1 oz. lots 4s. 4d. oz.
Riboflavin
100 g. 5½d. g.
10 g. 7d. „
Saccharin
500 g. £7 4s. for this quantity
Salicylic acid
B.P., dlvd. 3s. 2½d. to 5s. 6d. lb.
Silver nitrate
500 g. 5s. 0¾d. oz.
Sodium benzoate B.P.
1-cwt. lots 2s. 9½d. lb.
1-ton lots 2s. 7½d. „
Sodium salicylate
50 kg. 8s. 8d. kg.
12½ kg. 9s. „
Sodium thiosulphate
Crystals, photographic quality
1-ton lots 49s. cwt.
Stearic acid B.P.C. flake £159 ton
Strychnine 25 oz.
Alkaloid 5s. 10d.
Hydrochloride 4s. 11d.
Sulphate 4s. 11d.
Sulphaguanidine
12½ kg. 33s. kg.
50 kg. 32s. „
Sulphanilamide
12½ kg. 16s. 6d. kg.
50 kg. 15s. 4d. „
Sulphathiazole 12½ kg. 39s. 1½d. kg.
Tannic acid B.P. Lævis
1-cwt. lots 9s. lb.
Tartaric acid B.P.
Powder or granulated,
10 cwt. or more £14 cwt.
Terpineol, B.P.
40-gal. drums 2s. 5d. lb.
1-cwt. lots 2s. 8d. „
Theophylline B.P.
500 g. 27s. 6d. for this quantity
Thiamine hydrochloride
100 g. 4½d. g.
1 kg. £15 3s. 6d. kg.
Thioglycollate
Ammonium 12s. 4d. to 16s. 4d. lb.
Calcium:
7-lb. lots 17s. 3d. „
5-cwt. lots 14s. 3d. „
α-Tocopherol 10-g. lots 1s. 2d. g.
Vanillin 26s. to 30s. 6d. lb.
Zinc oxide, B.P.
2-ton lots £127 ton

GENERAL CHEMICALS

Acetic acid
1-ton lots dlvd.
80% Technical £99 ton
80% Pure £105 ,,
Glacial B.P. £114 ,,
99-100% Glacial £111 ,,
98-100% Glacial £108 ,,

Acetic anhydride
1-ton lots dlvd. £143 ton

Acetone
5-gal. drums, free, non-returnable £128 ton
40 to 45-gal. drums, 10-ton lots £88 ,,

Alum, potassium granular crystals
50 kg. 1s. 2d. kg.

Aluminium hydroxide B.P.C. 34
28-lb. lots 2s. 4d. lb.

Aluminium stearate
(Precipitate) 1-ton lots £263 ton

Ammonia
Persulphate £6 2s. 6d. cwt.
Phosphate: Mono- £106 ton
Di- £100 ,,

Amyl acetate
B.S.S. 10 tons and over £251 ton
Technical £249 ,,

Amyl alcohol
Technical in 1-ton lots £260 ton

Arsenic White powdered ex store £40-£45 ton

***n*-Butyl acetate**
10-ton lots £173 ton

***n*-Butyl alcohol** 10-ton lots £152 ton

Calcium chloride
Solid 70 to 72%, 4-ton lots £15 10s. ton

Calcium oxide (Lime)
ex marble 28-lb. lots 3s. 10d. lb.

Chloroform B.P. ½-ton lots 3s. 1½d. lb.

Chromic acid
Dlvd. U.K. (less 2½%) 2s. 0½d. to 2s. 0¾d. lb.

DDT 3s. 0½d. to 3s. 2d. lb.

2 : 4-Dichlorophenoxyacetic acid
99% pure, 1-cwt. bags £340 ton

Dimethyl sulphate 400 lb. drum lots 1s. 8d. lb.

Ether (Di ethyl ether)
Tech. B.S.S. and Solvent B.P.
1-ton lots in drums 2s. lb.

Ethyl acetate 10-ton lots £145 ton

Ethyl alcohol
95% Gay Lussac 66·0 o.p.
2,500 to over 300,000 proof gallons per year in tank wagons 4s. 0½d. to 4s. 2¾d. per proof gal.

Ferrous sulphate 50 kg. 1s. 4d. kg.

Formaldehyde
40% by volume dlvd. England
1-ton lots £38 15s. ton

Glycerin
1,260 s.g. chem. pure, 5 tons and up, 5-cwt. drums £201 10s. ton
1,260 s.g. refined pale straw, indus., 5 tons and up, 5-cwt. drums £196 10s. ton

Hexamine
1-ton lots
Technical, bulk 1s. 8d. lb.
B.P.C. 1s. 11d. ,,

Hydrochloric acid
Commercial 18s. 6d. cwt.

Hydrogen peroxide
27·5% weight £128 10s. ton
35% weight £158 ,,

Lactic acid (1-ton lots)
Pale tech. 44% by weight 1s. 3½d. lb.
Dark tech. 44% by weight 9½d. lb.

Magnesium chloride
Solid (ex wharf): 1-ton lots £17 10s. ton

Magnesium sulphate £14 10s. to £15 5s. ton

Mercurous chloride (calomel)
50 kg. 62s. 3d. kg.

Mercury sulphide, red
Ton lots and over 29s. 3d. lb.

Methylated spirits (Industrial)
Perfumery quality 500 gal. and upwards:
61 o.p. 7s. 4d.
74 o.p. 7s. 11½d.
5 to 10 gal.:
61 o.p. 8s. 8d.
74 o.p. 9s. 3½d.

Methyl ethyl ketone
10 tons dlvd. £143 ton

Methyl isobutyl carbinol
10 tons and up, in drums, dlvd. £163 ton

Methyl isobutyl ketone
10 to 50 tons, in drums, dlvd. £169 ton

Naphthalene
Crystal, dlvd., 4-ton lots, spot £65 4s. 3d. ton
Ball and flake (ditto) £73 14s. 3d. ,,

Nickel sulphate dlvd. ton lots £200 ton

Nitric acid 70% intermediate £32 ,,

Pentachlorphenol
Flake, technical, 1-ton lots, dlvd. 2s. 2d. lb.

Phenol Crystals:
Under 1 ton dlvd. 1s. 7d. lb.
10 tons and over dlvd. in returnable drums 1s. 4½d. lb.

Phthalates
10 ton lots in drums
Diethyl £187 10s. ton
Dimethyl £179 ton

Potassium bromide
50 kg. 5s. 6d. kg.
12½ kg. 5s. 8d. ,,

Potassium carbonate
Calcined 96 to 98% (1-ton lots ex store) £76 ton
Hydrated (1-ton lots) £74 10s. ,,

Potassium fluoride
28-lb. lots 5s. 1d. lb.

Potassium sodium tartrate
5-cwt. lots £10 cwt.

Sodium cyanide
96-98% £128 ton

Sodium hydroxide 28 lb. lots:
sticks (1 lb. bottles) 4s. 3d. lb.
pellets ,, ,, 3s. 9d. ,,

Sodium metal 28-lb. lots 3s. 8d. ,,

Sodium metasilicate
Dlvd. U.K. in ton lots £26 ton

Sodium phosphate
Dlvd. ton lots: Di-sodium, crystalline £40 10s. ton
Anhydrous £88 ,,
Tri-sodium, crystalline £39 ,,
Anhydrous £86 ,,

Sodium silicate
according to quantity, grade and delivery point £9 5s. to £15 ton

Sodium sulphate
Ex works:
(Glauber salt) £12 10s. ton
(Salt cake) unground, full truck loads £8 16s. 6d. ton

Sodium sulphide
Broken, returnable drums, dlvd. ton lots £37 2s. 6d. ton
Flake, ditto £38 12s. 6d. ,,
Solid, ditto £36 2s. 6d. ,,

Sodium sulphite
Commercial crystals 4-ton lots £24 10s. ,,
(Dlvd. London in 1-cwt. single non-returnable bags)

Sodium tripolyphosphate
1-ton lots £95 ton

Stannic chloride
28-lb. lots 8s. 11d. lb.

Stannous chloride
28-lb. lots 9s. 5d. lb.

Strontium carbonate
96-98% 28-lb. lots 3s. lb.

Zinc chloride
28-lb. lots sticks 6s. 9d. lb.

OILS AND FATS

Palm kernel oil
Refined, deodorised, 2-ton lots, naked, ex works £118 ton

Palm oil
Refined, deodorised, 2-ton lots, naked, ex works £108 ton

Stearine
Flake triple-pressed, dlvd. (bags free and non-returnable £154 ton

GUMS AND WAXES

Agar Agar No. 1
Kobe strip 13s. 6d. lb.
Powder 18s. 9d. ,,

Beeswax
Dar-es-Salaam spot (nominal) £30 cwt.
Sudan spot £27 ,,
Bleached white (slab) £31 ,,
Refined yellow (slab) £30 ,,

Benzoin
Sumatra spot £28 cwt.
Siam spot £2 7s. 6d. lb.

Candelilla
Spot £25 10s. cwt.

Carnauba
Prime, Spot £60 10s. cwt.
Fatty grey £29 5s. ,,

Gum arabic
Lump £7 10s. cwt.

Karaya
Powder, Spot 3s. 7d. lb.

Paraffin wax
1-ton lots, acc. to grade £87 10s. to £120 ton

Peru balsam 12s. lb.

Shellac
No. 1 orange £13 15s. cwt.
No. 2 orange £13 ,,
Transparent white 4s. 9d. lb.
Pale dewaxed 5s. 9d. ,,

Tragacanth
No. 1 spot £160 cwt.
No. 2 spot £145 ,,
Pale leaf £60 ,,
Amber ,, £42 ,,
Brown to Red £30 ,,

NEW TRADE MARKS

APPLICATIONS

Cosmetics and toilet preparations

FRISCOTA.—753,720. *Eau de Cologne and Parfumerie-Fabrik, No.* 4711.

SUNCROFT.—768,748. *C. W. Field Ltd.*

DEUCE 2.—762,969. *Harry Coleman.*

SINISTRE.—769,712; SARABANDE.—769,863. *Merton Ian Behrman.*

HOSTESS.—762,477. *Berkeley Perfumery Co. Ltd.*

BINT EL FREETOWN. — 763,002 *Molly Richards Ltd.*

MAI DOKIN SUKAWA.—766,362. *A. Boake Roberts and Co. Ltd.*

FORMTEX.—767,703. *Wella Rapid Ltd.*

SUPER-STAY. — 749,324. *Lehn and Fink Products Corporation.*

EBONA.—768,062. *Picot Ltd.*

Pesticides and herbicides

RANDOX.—765,571. *Monsanto Chemical Co.*

ARICIDE.—766,747. *May and Baker Ltd.*

AYRTOSECT. — 769,627. *Ayrton, Saunders and Co. Ltd.*

CITRAMAC.—765,275. *Siegfried A.G.*

TENATOX.—767,517. *Associated Fumigators Ltd.*

DELNAV.—768,031. *Hercules Powder Co.*

VARITOX.—769,192. *May and Baker Ltd.*

Pharmaceuticals

METHALUTON. — 765,799. *Parke, Davis and Co.*

PROTAMYL.—767,623. *May and Baker Ltd.*

ADMINS.—767,765. *Optrex Ltd.*

MENQUIL. — 768,077. *Organon Laboratories Ltd.*

BACTROBAN.—768,240. *Macleans Ltd.*

SUN-VIT.—768,550. *Daniel Harper.*

PHOLCOIDS.—768,953. *Smith Kendon Ltd.*

GLIPASOL. — 769,353. *May and Baker Ltd.*

TONELLA.—769,401. *Merton Maurice Shiers.*

ATTENULIN.—769,599. *Allen and Hanburys Ltd.*

COLENZA.—769,647. *Metropolitan Drug Co. Ltd.*

HALYCON.—761,494. *Carter Products Inc.*

COLCHIPIRINE.—B747,623. *Continental Laboratories Ltd.*

ANGETTES. — 757,497. *Bristol-Myers Co. Ltd.*

KK.—758,114. *K and K Organics Ltd.*

VORITA.—761,456. *Domestos Ltd.*

CAPTIDE.—766,724. *Glaxo Laboratories Ltd.*

PERCODAN.—767,140. *Endo Laboratories Inc.*

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C.2.

Mirclaire Beauty Products Ltd. 2.12.57. 128 Crawford Street, Baker Street, London, W.1. Manfrs. and distillers of and dlrs. in perfumes and essences, creams, soaps, etc. £2,000. Dirs.: Miss E. L. Parker, Mrs. N. Napier and Mrs. E. Barclay.

Rossmore Pharmacy Ltd. 2.12.57. 219 Albert Road, Parkstone, Dorset. Bus. of pharmaceutical and dispensing chemist and druggist cd. on by Reginald H. Jarmin, etc. £3,000. Dirs.: R. H. Jarmin and B. W. A. Young.

Peter Brand (Dispensing Chemists) Ltd. 6.11.57. 48 The Grove, Christchurch, Hants. £100. Dirs.: P. N. and Mrs. E. Brand.

Black's Pharmacies Ltd. 13.11.57, 17 Brandon Street, Hamilton Square. Birkenhead. £100. Dirs.: E. R. and Mrs. L. Black.

Greenwood Laboratories Ltd. 15.11.57. 199 Piccadilly, London, W.1. Manfrs. of pharmaceutical and food products. £10,000. Dirs.: J. Shaw and R. F. Inch.

Aerosol Research Co. (Great Britain) Ltd. 15.11.57. Room 150, 20 Copthall Avenue, London, E.C.2. Designers and manfrs. of and dirs. in valves of all kinds, particularly for pressure-tight containers and aerosol packages, etc. £1,000. Subs.: W. M. Pybus and H. S. Garfield.

A. H. Fussell Ltd. 18.11.57. 9 Clare Street, Bristol 1. Retail chemists and druggists, etc. £100. Dirs.: Winifred E. Fussell and Pauline E. Armitage.

NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Pharmaceuticals

Spasmolytic. *N.V. Nederlandsche Combinatie voor Chemische Ind.* 768,788.

3 - phthalimido - 2,6 - dioxopiperidines with therapeutic properties for central attenuation, etc. *Chemie Grunenthal G.m.b.H.* 768,821.

Cyclopentyl derivatives as sedatives, anti-convulsants, and therapeutic intermediates. *Cassells Farbwerke Mainkur A.G.* 768,840.

Antipyretic, analgesic. *Geigy A.G.* 769,285.

Hyaluronic acid. *American Home Products Corp.* 769,287.

N - dialkyl sulphamyl piperazines. *American Cyanamid Co.* 769,275.

Cough treatment. *Lepetit S.A.* 769,272.

Sedatives. *Hoffmann-La Roche and Co.* 769,261.

Vasoconstrictors with local action. *H. Morren.* 769,248.

Antipyretics and analgesics. *Hoffmann-La Roche and Co.* 769,246.

Endodextranase, enzyme for splitting glucosidic links in dextrans. *Commonwealth Eng. Co. of Ohio.* 767,671.

Detection of Ca in body fluids. *Sulkowitch.* 769,289.

Plastics

Polymers prepared from acrylonitrile. *Kodak Ltd.* 764,299, 764,300 and 764,301.

Composite plastic structural unit and manufacture thereof. *Farbenfabriken Bayer A.G.* 764,330.

Process for producing thin-walled tubes from normally crystalline polymers. *Dow Chemical Co.* 764,355.

Manufacturing Chemist's **ENQUIRY BUREAU**

Leonard Hill House, Eden Street, London, N.W.1.

Readers requiring names of suppliers of chemicals or plant should state their needs on this form, giving approximate quantities, clip it to their business noteheading and send it to the Bureau, as above. Please type or use block letters.

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For office use. *No.* *Date.*

Sixty Years Ago

From MANUFACTURING CHEMIST, January 1898

Barber shop hygiene

The latest, with respect to bacteria, is as a by-product of the barber's shop, the Parisian Prefecture of the Police having determined that all combs used for more than one person must be of nickel plate, and that brush backs must be of metal. Moreover, after each operation, the hair is to be removed, the artist must wash his hands before attending to " next gentleman, please " and all his instruments must be left in boiling water for ten minutes before being applied to another customer.

A poor, innocent, inoffensive female child has been born to a drug representative in the west, and on the authority of *Meyer Brother's Druggist*, he is about to christen it after the speciality he is travelling in—" Bromo-Seltzer Mathison."

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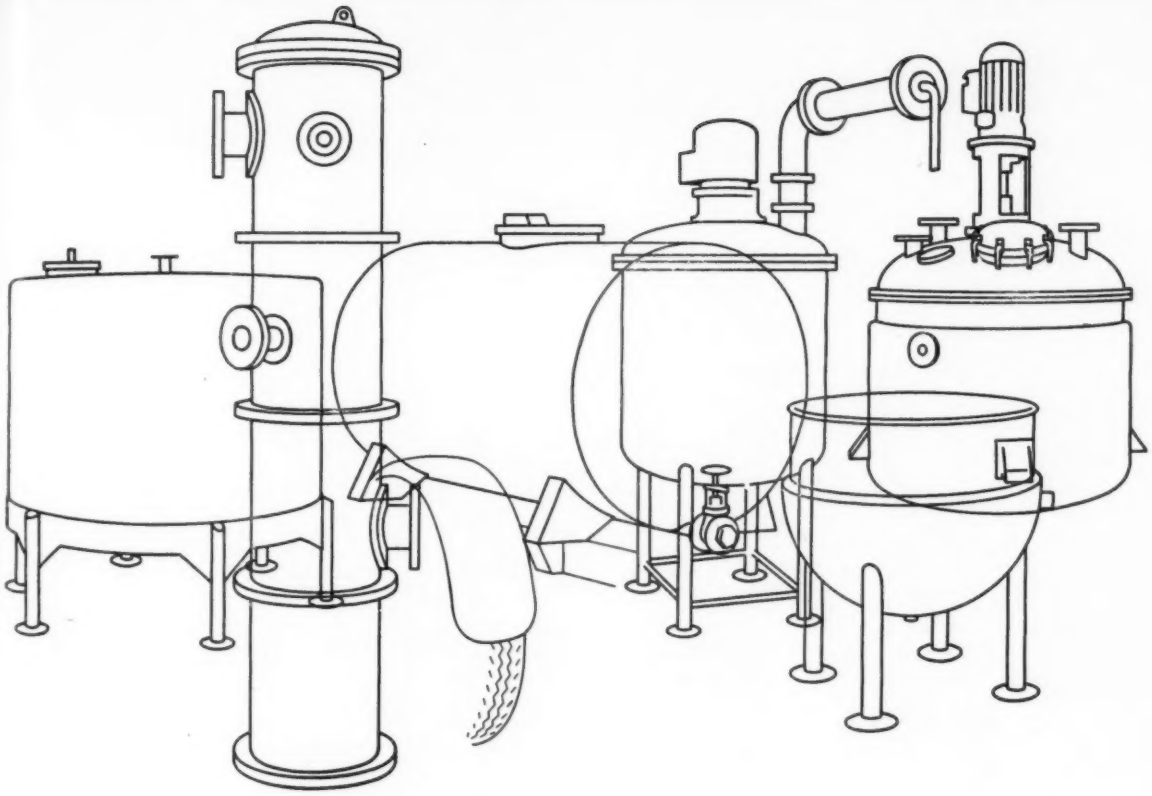
The Exhibition will be supported by an intensive publicity campaign to attract farmers, foresters, planters, market gardeners, amateur gardeners, and public health officials. Invitations are being sent to Departments of Agriculture, Research Stations, Agricultural Colleges, and other establishments in Britain and all overseas countries. An Official Exhibition Dinner will be held, to which leading personalities in the fields of agriculture and pest control will be invited.

Overseas propaganda will be directed, in part, to attract many of the agriculturists and horticulturists among the many thousands of Americans and other visitors who will be travelling to Europe this year for the main purpose of visiting the Universal and International Exhibition at Brussels.

Prices of stands are reasonable, and exhibitors have the choice of erecting their own stand or renting an attractively designed "shell" stand. Full information and a descriptive brochure are available from the Exhibition Sales Manager, Crop Protection and Pest Control Exhibition, Leonard Hill House, Eden Street, London, N.W.1. (Telephone: EUSton 5911.)



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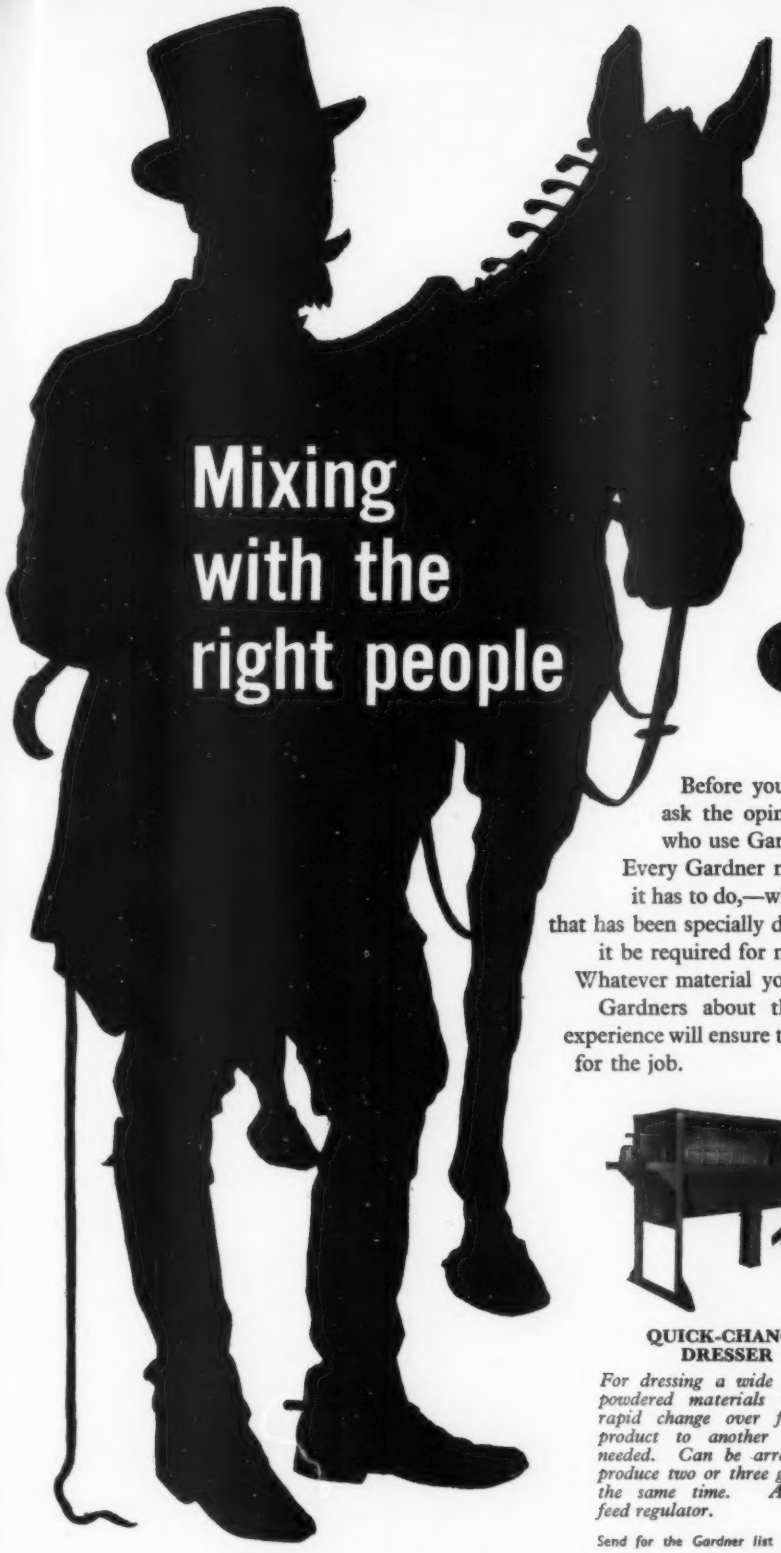

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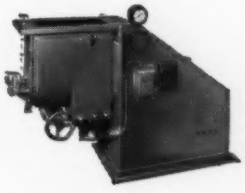

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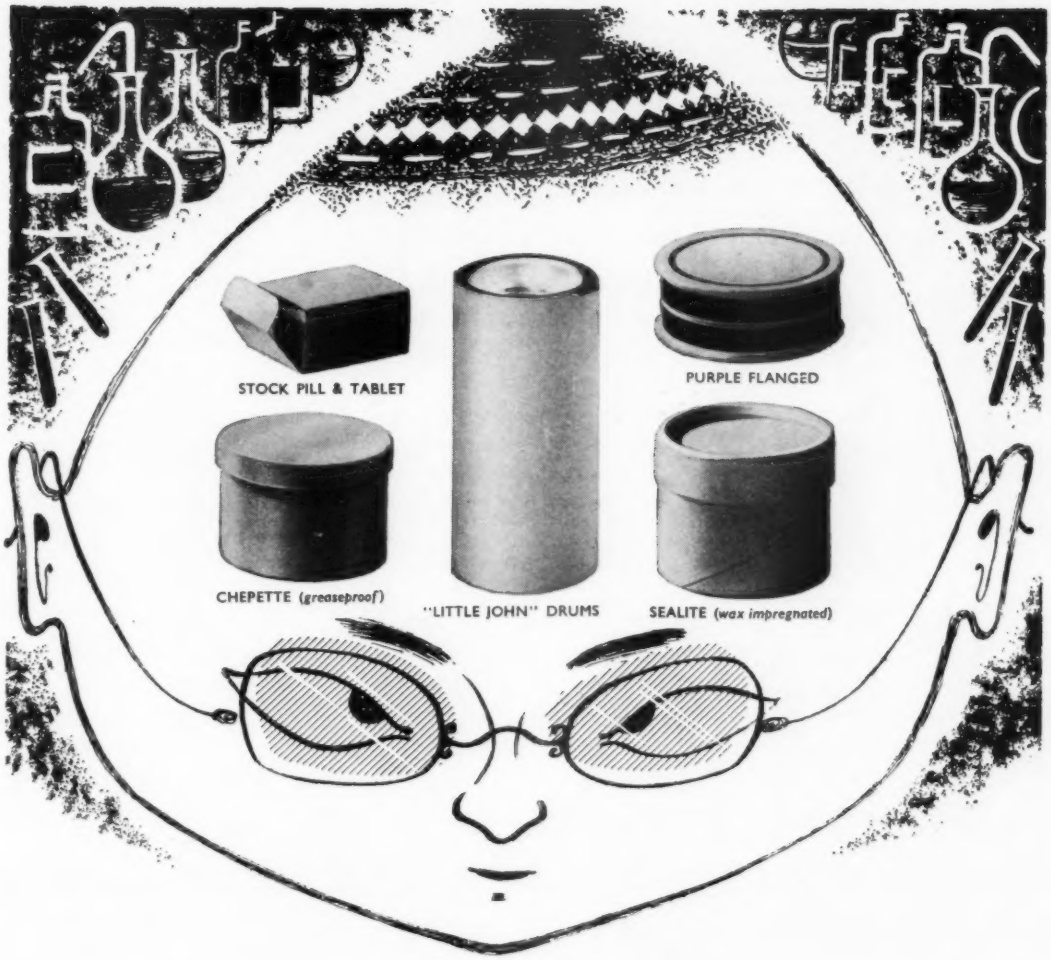

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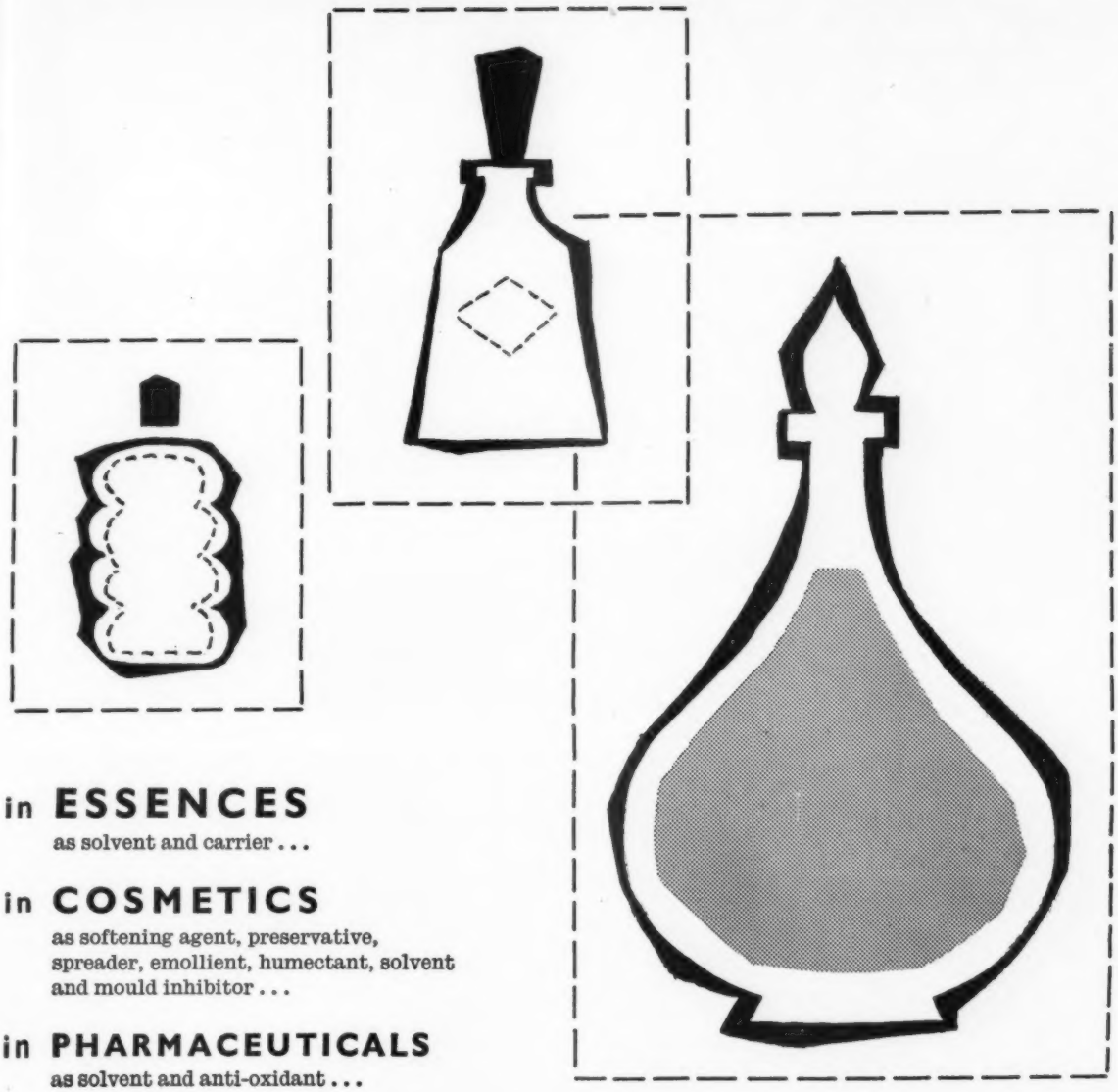

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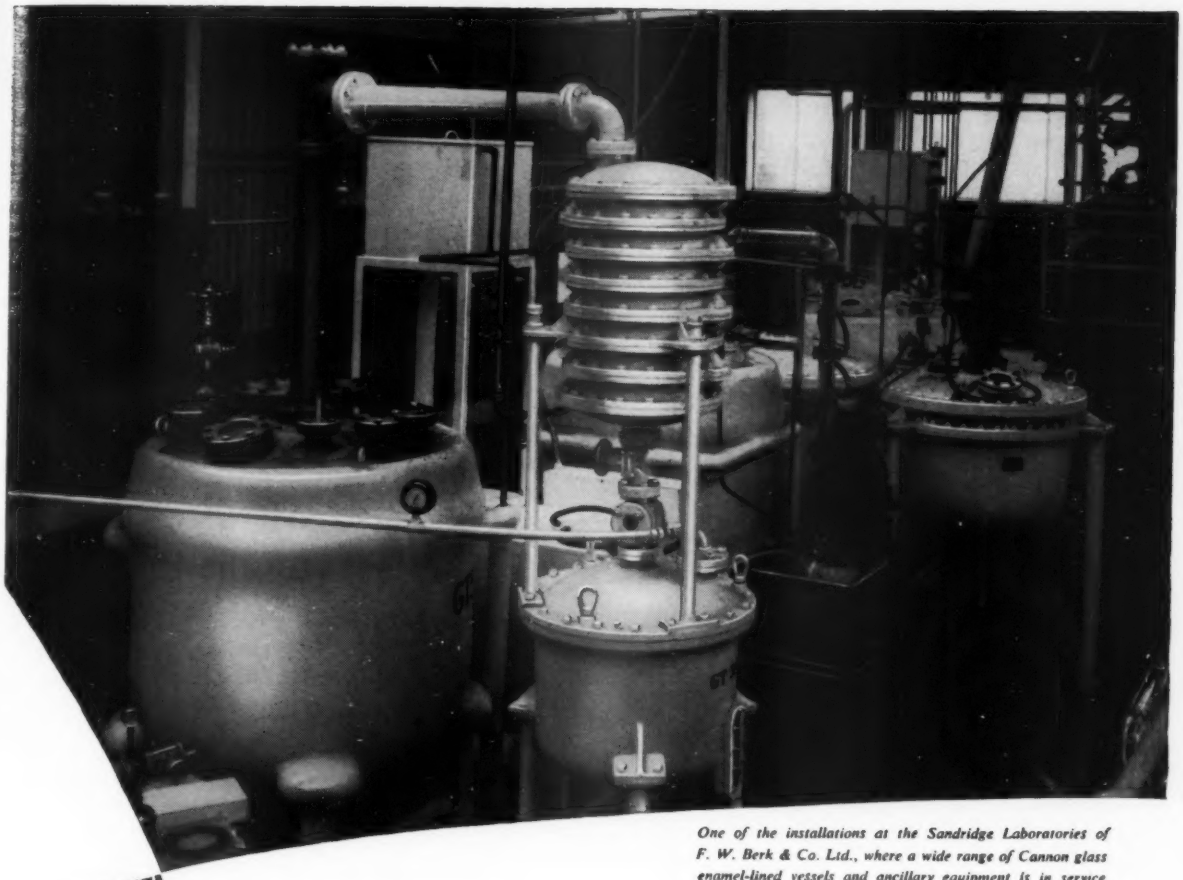

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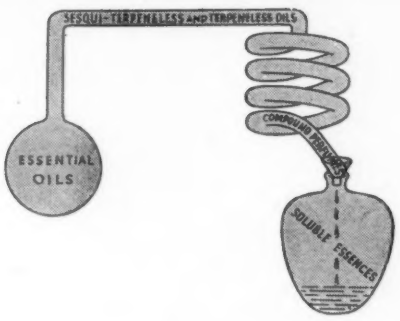

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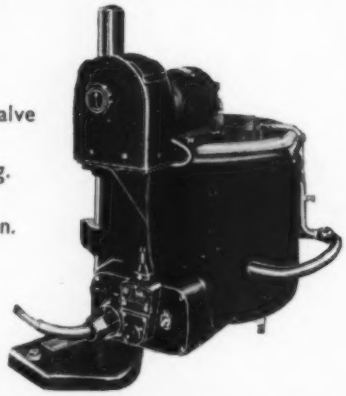

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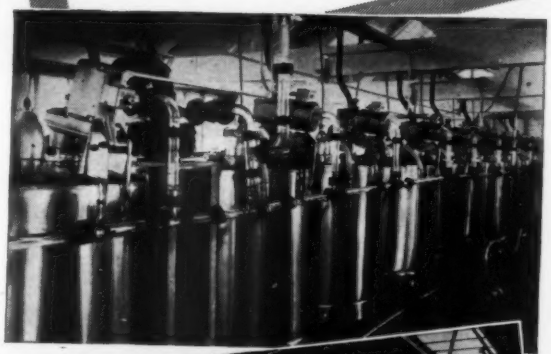

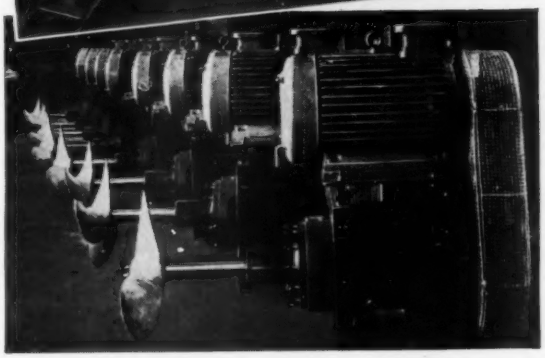

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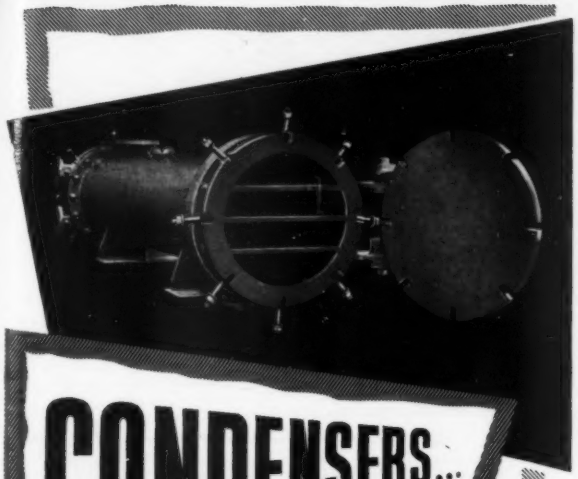

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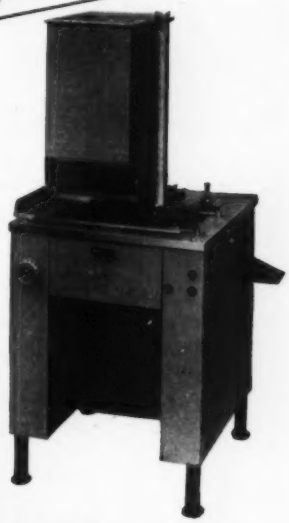

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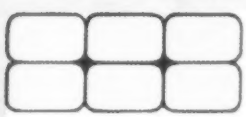

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